

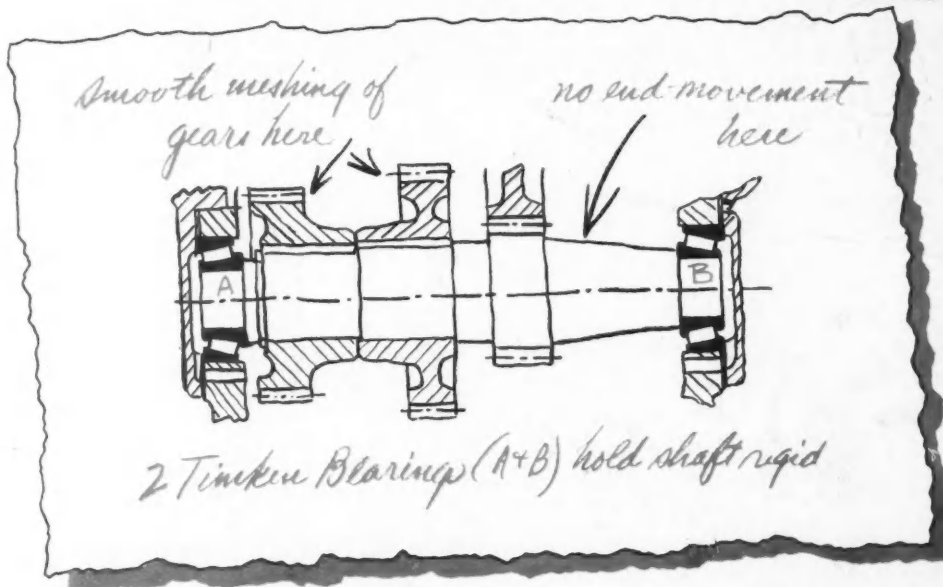
# AUTOMOTIVE and Aviation INDUSTRIES

JUNE 15, 1947



Engineering Library

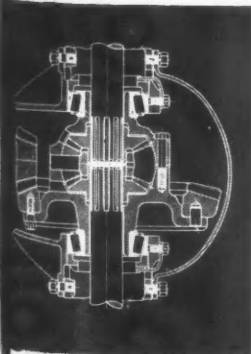
## How to end end-movement in your automatic transmission



Engineering Library

If you want to put an end to end-movement in your new automatic transmission, you've got to be sure the gears and shafts will always be held in rigid alignment. That's the job that Timken tapered roller bearings have been doing for years in many heavy duty applications such as the truck transmission sketched above.

Timken bearings on your automatic transmission countershaft will insure better gear contact, less wear and longer life. Deflections and end-movement will be eliminated. And because their tapered design takes both radial and thrust loads, there's no need for separate thrust bearings. Designs can be simplified.



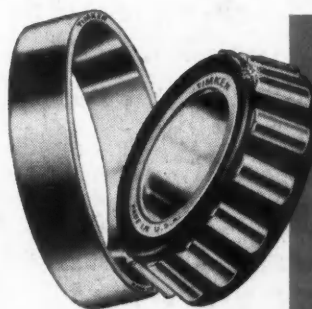
**LOOK AT DIFFERENTIAL MOUNTINGS FOR EXAMPLE . . .** Here's another application where Timken tapered roller bearings

have proved their ability to take the toughest loads in any combination. In differentials, pinions, wheels, steering parts wherever wheels and shafts turn—Timken bearings mean longer life, less wear and smoother performance.

That's because Timken bearings are made of Timken fine alloy steel. And because the Timken Company is the acknowledged leader in advanced design, precision manufacture and rigid quality control.

We've been working hand in hand with the auto industry ever since the horse and buggy days. Our engineering facilities are yours for the asking. If you're designing an automatic transmission—CALL IN TIMKEN\* . . . NOW! In Detroit just pick up the phone and call MADison 1380. The Timken Roller Bearing Company, Canton 6, Ohio.

**NOTE TO P.A.'S.** Because every step of the manufacture of Timken bearings is controlled within our company . . . because our vast manufacturing facilities are widely dispersed . . . you will find the Timken Company a supply source of outstanding reliability.



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NOT JUST A BALL ○ NOT JUST A ROLLER □ THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST —○— LOADS OR ANY COMBINATION



# WHERE PRECISION IS MAXIMUM YET PRODUCTION IS MODERATE

Here's how it's done on a Heald No. 48-A Bore-Matic

The customer's production requirements on this refrigerator piston and connecting rod job were moderate. He wanted low-cost manufacture with maximum precision.

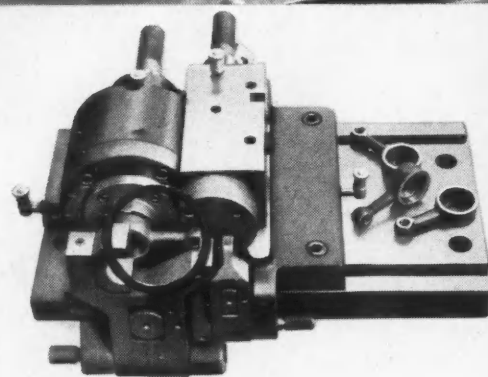
Heald engineers tooled up the No. 48-A Precision Bore-Matic shown below with two separate holding fixtures. One is for finish-boring the wrist pin holes in the pistons. And the other holds the connecting rods, in which the wrist pin hole is finished to a .0002" size tolerance and the crank bore to a .0005" tolerance.

Chances are, too, that the right Heald Bore-Matic can solve your precision finishing problems—on jobs involving boring, turning, facing, grooving, chamfering, and even forming—singly or in multiple machining operations.

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... less cost



This connecting rod-holding fixture is easily substituted for the piston-holding fixture shown on the machine. Cross slide has aligning rails for locating fixtures positively without having to line them up each time they're changed.

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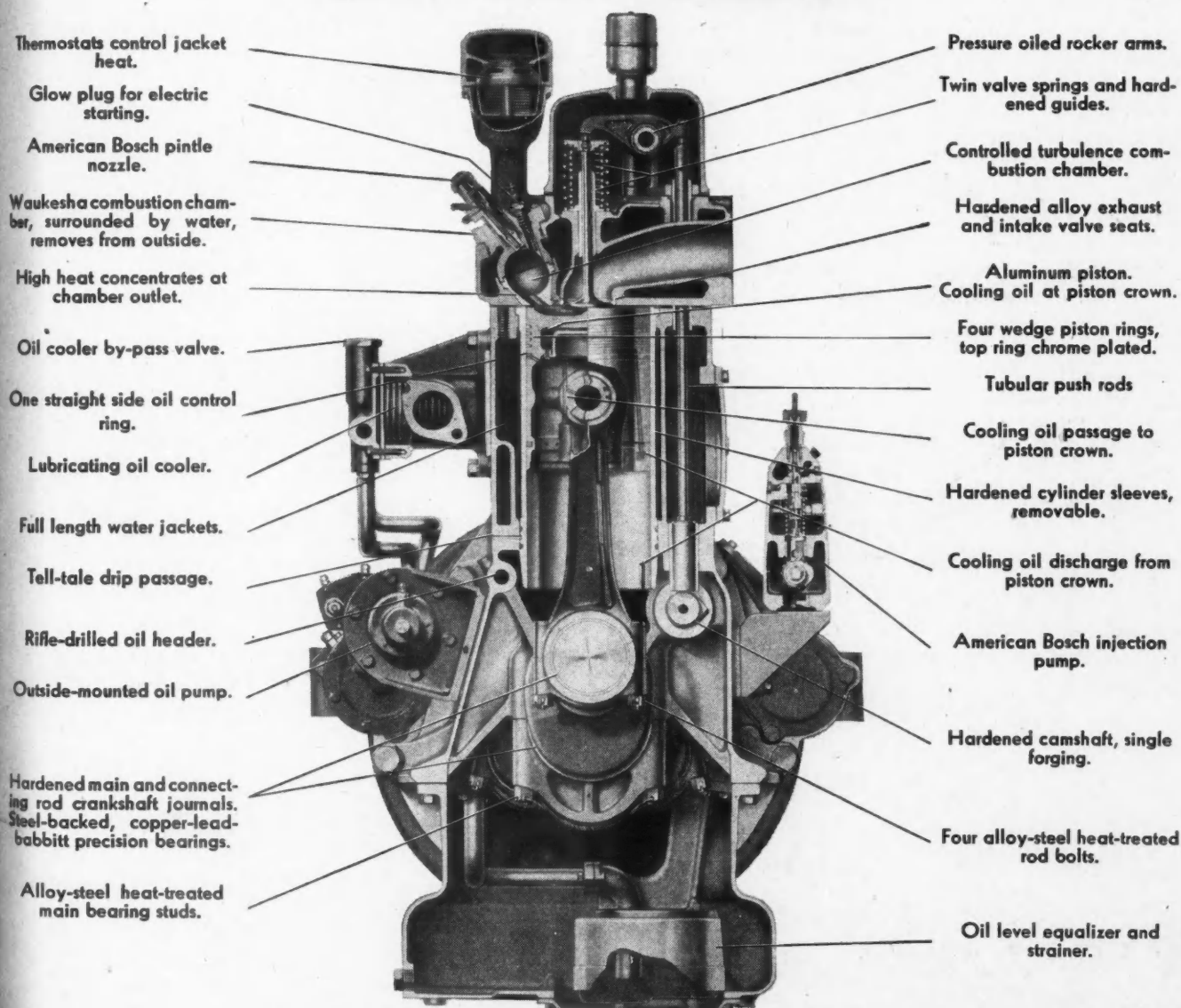
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# AUTOMOTIVE and Aviation INDUSTRIES

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June 15, 1947

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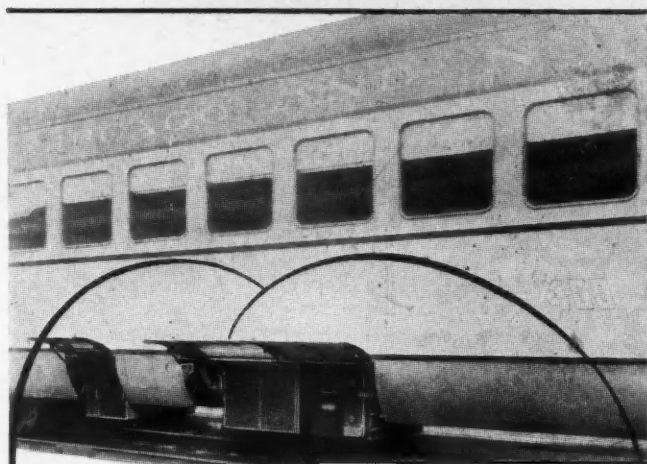
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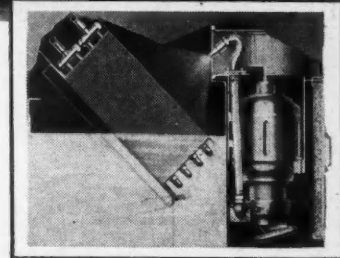
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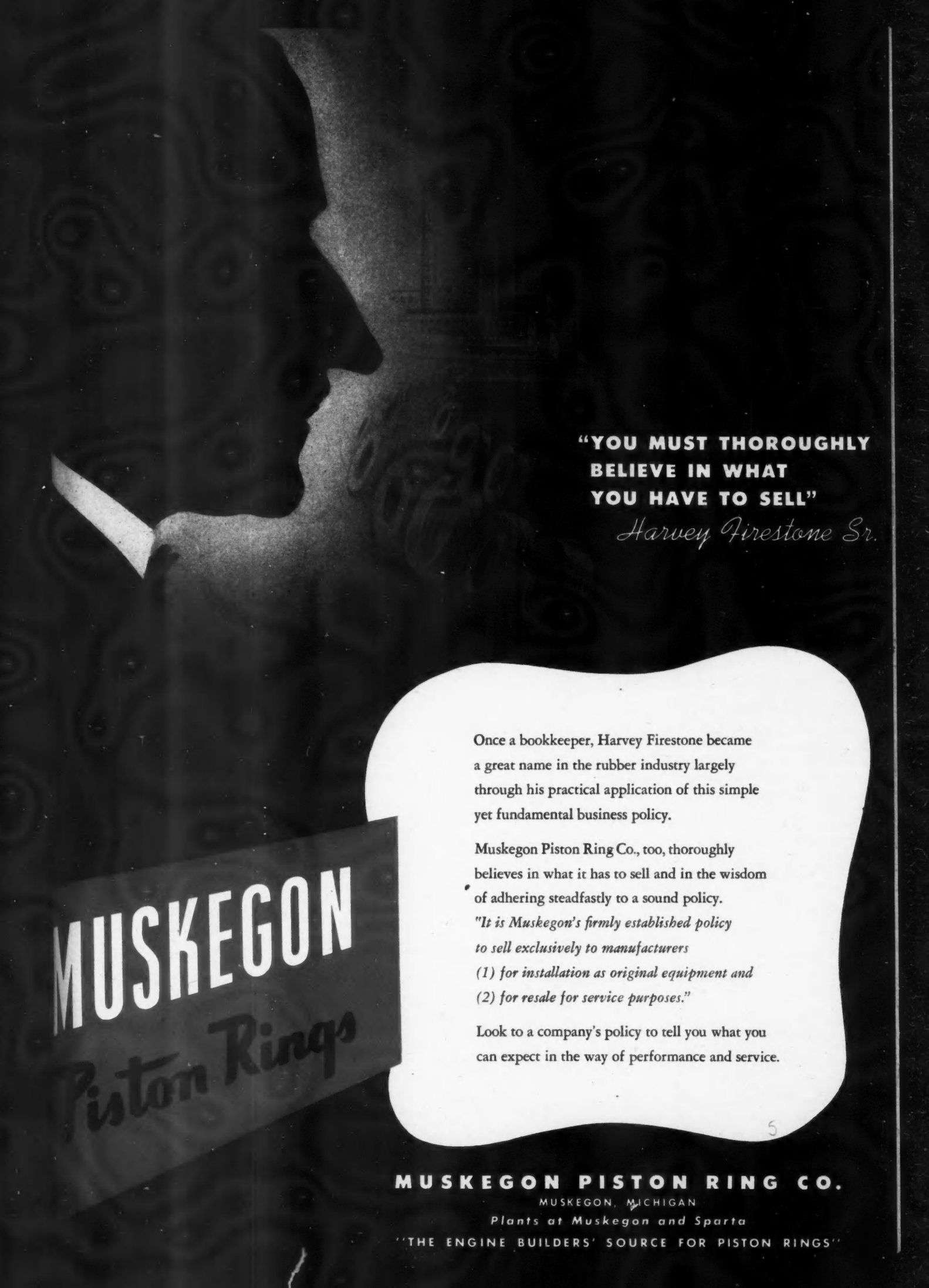


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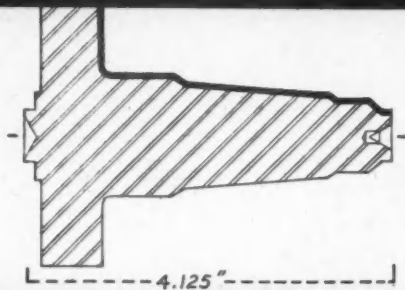


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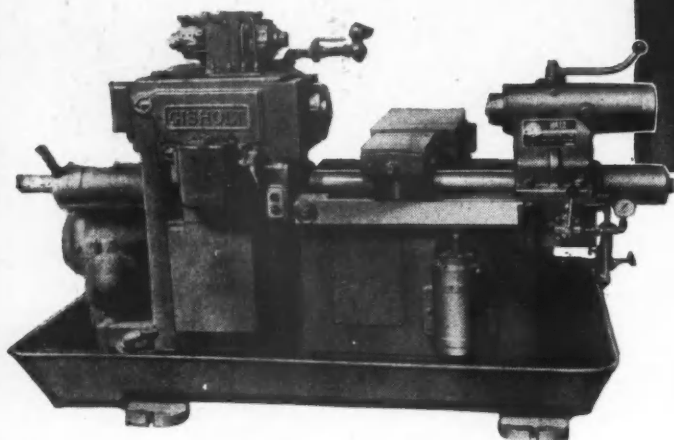
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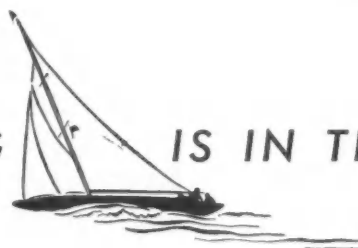
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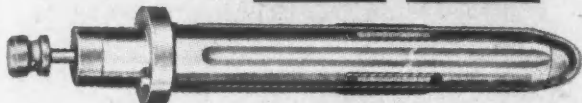
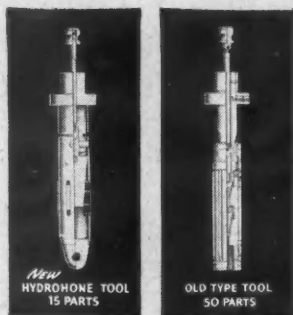


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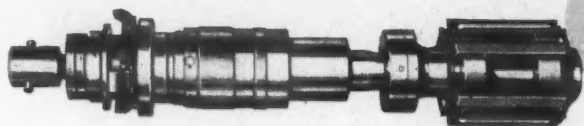
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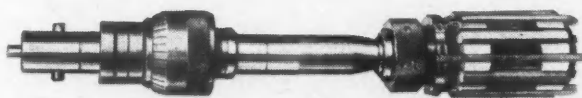


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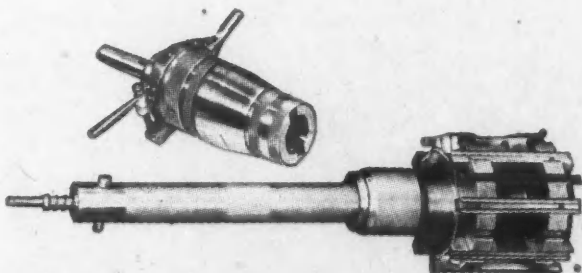
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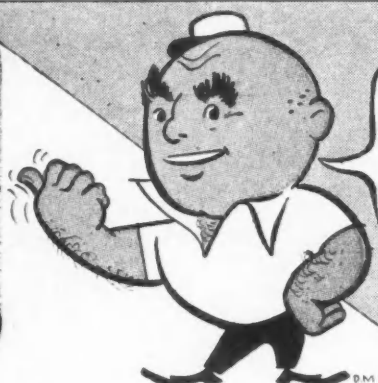
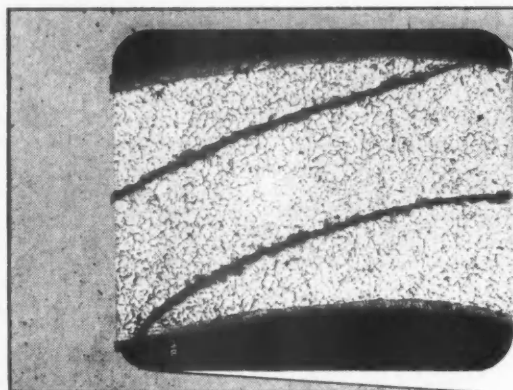
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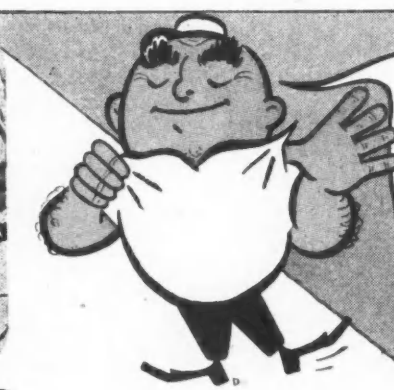
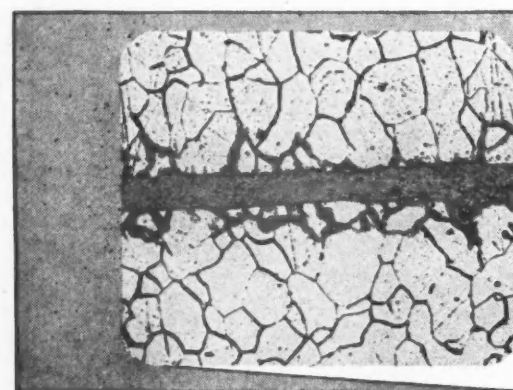
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Pacific Metals Co., Ltd. 3100 19th St. San Francisco 10, Calif.	Standard Tube Sales Corp. 1 Admiral Ave. Maspeth, N.Y.C., N.Y.	Lapham-Hickey Co. 3333 W. 47th Place Chicago 32, Illinois	Rutan & Co. 404 Architects Bldg. Phila. 3, Pa.	Eagle Metals Co. 3628 E. Marginal Way Seattle 4, Wash.	Alloy Metal Sales Ltd. 861 Bay St. Toronto 5, Canada
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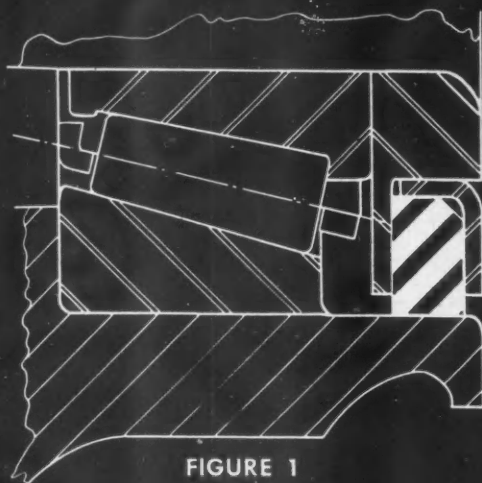


FIGURE 1

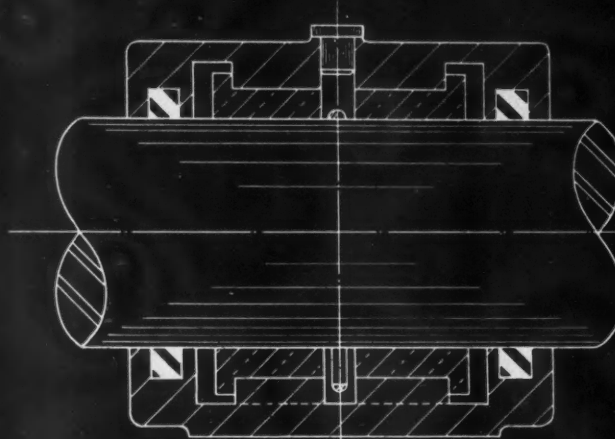


FIGURE 2

## SEALING ROTATING PARTS EFFICIENTLY

### *Factors favoring use of simple, compressible rings*

A compressible ring, placed either in a counterbore or in a groove, offers an effective yet simple means of sealing rotating parts. Properly designed and installed, such a ring is non-binding, non-scoring. It can be made comparatively small in cross section when space must be conserved. Since it does not depend for its effectiveness upon springs, fingers, or other mechanical parts, it is relatively low in cost.

Armstrong's Cork-and-Synthetic-Rubber Compositions make excellent ring-type seals. These compositions combine the oil resistance and strength of synthetic rubber with the true compressibility of cork. Under compression, each air-filled cell of cork acts, in effect, as a self-contained spring. Constant pressure is maintained against the moving part without extrusion of the sealing medium.

To insure radial compression when assembled, cork-and-synthetic-rubber rings are normally designed with the I.D.  $\frac{1}{64}$ " scant, the O.D. and the thickness  $\frac{1}{32}$ " full. These allowances, however, are influenced by the size of the ring, the speed of the sealed part, and by the pressures involved.

Shown above in Figure 1 is an application of a cork-and-synthetic-rubber ring used as a roller-bearing

ing grease shield. The designer of this unit had first specified an impregnated fabric for the shield, but the fabric proved to be too rigid. Fabric also was expensive, for it had to be cut from sheet material. The final answer was a lathe-cut ring of Armstrong's DC-100. This oil-resistant material gave the permanent resiliency required, was more easily assembled, had lower initial cost and had a longer service life. Half rings or strips also can be supplied for use in split housings as illustrated above in Figure 2.

While cork-and-synthetic-rubber compositions are high-friction materials, binding is easily prevented by applying oil, grease, or other lubricants to the ring. One lubrication lasts for the life of the seal. Lubricant can be applied either in your factory or ours.

Since minor design details often exert great influence on the choice of a sealing material, we suggest that you call in an Armstrong Representative before setting up specifications. He'll be glad to suggest suitable materials and supply samples for testing.

If you prefer, send drawings and details directly to Armstrong's Gaskets and Packings Dept. You'll find our recommendations unbiased and keyed to good current sealing practice.



#### SEND FOR FREE BOOKLET.

For specification and application data on Armstrong's more than 50 resilient sealing materials, send for a free copy of the latest edition of "Gaskets, Packings, and Seals," twelve pages of helpful information. Address Armstrong Cork Company, Gaskets and Packings Department, 1506 Arch Street, Lancaster, Penna.



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Synthetic Rubber Compounds • Cork-and-Rubber Compositions  
Fiber Sheet Packings • Rag Felt Papers • Natural Cork





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REPUBLIC 3000 PLAZA 6780 AVON 2730  
TELETYPE NUMBERS: CHGO 1269 • DET 33 • CIN 64

RIES



## Some High Spots of this Issue

### ***Cadillac Modernizes Its Foundry***

Latest available mechanized equipment for handling operations and for automatic charging of cupolas, and a comprehensive ventilation system, have been installed to increase operating economy and worker comfort. Also presented is a detailed floor plan and equipment layout. The article begins on page 24.

### ***Hall-Scott's High Output Truck Engines***

Interrupted by the war just as it was starting to build its 400 series engines of 855 to 1090 cu in. displacement, Hall-Scott has resumed their production. Supplementing the description of the major design features are sectional drawings, the first to be published. See page 28.

### ***Do Higher Octane Gasolines Favor the V Engine?***

Important consideration in this article by P. M. Heldt, former Engineering Editor of Automotive Industries, is the analysis of crankshaft torsional vibration in eight-cylinder in-line and V-eight engines having high compression ratios to utilize high octane gasolines. For his answer, turn to page 30.

### ***Chevrolet Announces New Trucks***

Major improvements in the Thriftmaster and Loadmaster series include longer wheelbases, higher gross vehicles ratings, longer CA dimensions, new cabs and bodies. A comprehensive description of the changes and tabulation of design data begin on page 33.

### ***Highlights of SAE Summer Meeting***

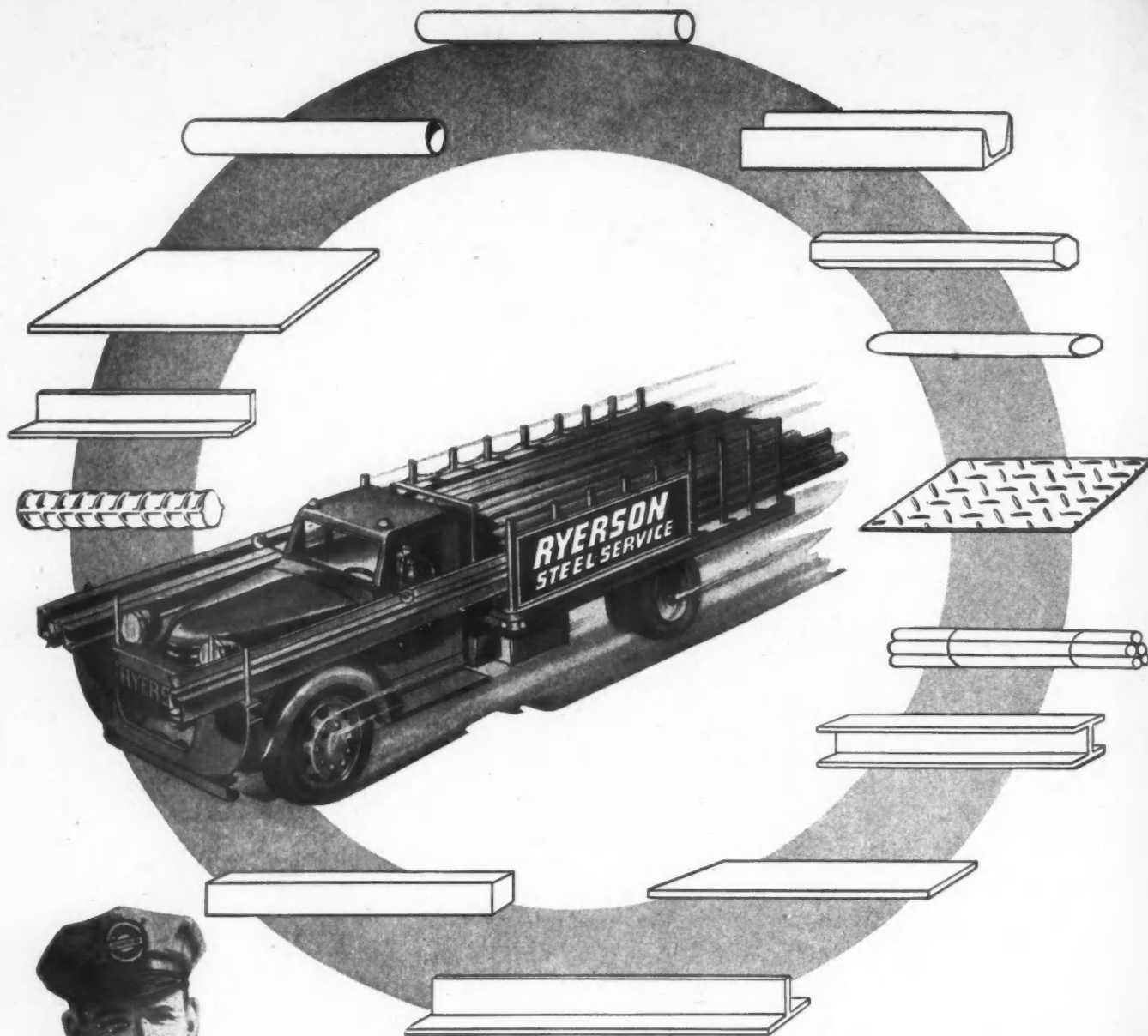
The high compression ratio (12.5 to 1) engine developed by the General Motors Research Laboratories under the direction of Charles F. Kettering, construction and operation of automatic transmissions and clutches, a new fuel injection engine with spark ignition, and vapor powerplants for motor vehicles. See page 38.

### ***32 Items of New Production Equipment and New Products And Other High Spots Such As:***

ASTM Specifications for Electrodeposited Coatings, Automotive Observations, Airbriefs, and Fruehauf's Special Equipment for Processing Torsion Bar Springs and for Welding Body Panels.

### ***Comprehensive Interpretation of Industry News, Page 17***

***For Complete Table of Contents See Page 3***



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experienced steel men. And if the steel you need is not readily available from stock, every effort will be made to find an alternate to serve your purpose.

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# **RYERSON STEEL**



# NEWS *of the* Industry

## Radical Ford Change News Not Too Surprising

No one in Detroit was particularly surprised when Henry Ford II told Ford dealers at Kansas City that the 1948 Ford model would be as radically changed from the present design as the model A was from the model T. J. R. Davis, vice-president and director of sales, had made an identical statement many weeks ago. So far the chief mechanical change known about is the abandonment of the traditional transverse springing in favor of coil and leaf springing in possible combination with a Hotchkiss drive. Tooling work for the new model is known to be progressing rapidly and Ford is reported to have placed 200,000 hours of die work in Detroit in addition to operations in the Ford tool and die shop, one of the largest in the world. Even so, it looks as though it will be well

into 1948 before the new model Ford will appear. It is understood that 1948 Ford and Mercury lines will be very much different.

## Buick Reported Considering New Automatic Transmission

It is reported that Buick Div. of General Motors Corp. is considering adoption of an automatic transmission, but that it is not the Hydramatic. This had been reported previously about Chevrolet and Pontiac. When these developments will materialize still appears to be cloaked in obscurity, but there is little doubt in Detroit that some type of automatic transmission for all cars will not be too long delayed. The experience with Hydramatic on Oldsmobile and Cadillac has shown that the public is sold on the driving ease of the self-shifting transmission.

## Willys Alone In Light Car Field

With the Chevrolet light car project on the shelf, Willys-Overland Motors, Inc. is about the only contender left in the smaller light car field. However, the company does not seem to be ready with its passenger car model. It is known that the original postwar Willys passenger car which was shown to the press last year has been abandoned and that a new model more in keeping with the present trend is under consideration. The so-called swinging differential and the previous concept of body styling are reported to be out. Willys has under development a new open type passenger vehicle using the four cylinder engine used in the Jeep and station wagon but further details are confidential at this time. The company is also developing a more luxurious model of its station wagon

## The Indianapolis Winner



Flashing across the finish line at an average speed of 116.338 mph, Mauri Rose driving a Blue Crown Special won the 31st running of the International 500 Mile Race at Indianapolis. Bill Holland finished second, driving a Blue Crown Special at an average speed of 116.097; third, Ted Horn, Bennett Bros.

Special, 114.799; fourth, Ardinger and Bergere, Nov Gov. Mobil Special, 113.404; fifth, Jimmy Jackson, Jim Hussey Special, 112.834; sixth, Rex Mays, Bowes Sealfast Special, 111.056; and seventh, Walt Brown, Permafuse Special, 101.744. (Please turn to page 100 for other details.) International News photo

# NEWS of the INDUSTRY

## Detects—Warns—Extinguishes



*In the fire extinguishing system for bus engines sketched above, fire detectors automatically flash a warning light on the dashboard at the first sign of a fire. Carbon dioxide can then be released by the driver from a remote pull handle. Authenticated News photo.*

with more attractive exterior colors and interior refinements such as carpeting and fabric upholstery instead of leather. The company currently is completing a new \$5 million press shop.

### Ford in Farm Implement Business in Big Way

The farm machinery field is going to be entered by the Ford Motor Co. in a substantial manner. New Ford tractors are to be delivered through the Dearborn Motors Corp., a subsidiary of Ford, on July 7, and initially the manufacturing plant will have a daily rate of 400 tractors. Fordson tractors are being produced by Ford for the Ford-Ferguson Co. under a contract which expires July 1. Ernest R. Breech, executive vice-president, has indicated Ford's intense interest in the whole farm picture and has stated that the new tractor business will be entirely separated from motor cars and that Dearborn Motors will have its own distributors.

Dearborn Motors was established to distribute the Ford tractors and implements are manufactured by independent manufacturers. Ford is all set up for production of the new tractor at the Highland Park plant to which tractor production was transferred from the Rouge plant two years ago. It now has about

420,000 sq ft of space devoted to tractor production.

### Factory Sales Show Only Small Gain in Exports

Charges that current domestic automobile shortages are due to greatly increased exports since controls were removed are proved unfounded by a report on factory sales issued by the Automobile Manufacturers Association. It reveals that the total percentage of exports of passenger cars and trucks was up only slightly during the first four months of 1947,

as compared with the comparable period a year ago. During the first four months of 1946, U. S. total production of passenger cars was 332,592 of which 19,036 or 5.7 per cent were exported. During the same period this year the industry built 1,129,549 cars and exported 7.7 per cent or 87,838. Motor truck exports for the first four months of this year were 22.3 per cent compared with 21.1 per cent over the same period a year ago.

### Kettering and Smith Retire; McCuen, Hogan Succeed

Charles F. Kettering, vice president in charge of the Research Laboratories Div., and John Thomas Smith, vice president and general counsel, of General Motors Corp. retired recently. The normal retirement age had been reached by both. Charles L. McCuen, formerly vice president in charge of the engineering staff, will become general manager of the Research Laboratories, succeeding Mr. Kettering. James M. Crawford will succeed Mr. McCuen as vice president in charge of the engineering staff, and Henry M. Hogan, vice president and assistant general counsel, succeeds Mr. Smith as general counsel.

Mr. Kettering will remain a director and act as a consultant of GM. Beginning his close association with GM in 1920, Mr. Kettering had been widely known for his development of the Delco electric starting, lighting and ignition system, the Delco farm lighting system, and the electric cash register. The two-cycle Diesel engine, tetra-ethyl lead, new improved Freon refrigerant, and a new fuel-saving high compression gasoline engine were among GM's research organization developments under Mr. Kettering's direction.

### Motor Vehicle Factory Sales from U. S. Plants\*

				Totals		
	Passenger Cars	Trucks	Buses	1947	1946	1941
January	247,130	101,092	1,240	349,462	101,867	413,012
February	266,237	106,339	1,211	373,787	93,042	387,067
March	301,810	118,046	1,421	421,277	124,003	416,016
April	314,372	106,780	1,650	422,782	214,350	378,908
Four Months	1,129,549	432,237	5,522	1,567,308	533,262	1,605,001

#### FACTORY SALES TO DOMESTIC AND FOREIGN MARKETS

	Passenger Cars		Trucks		Buses	
	Domestic	Foreign	Domestic	Foreign	Domestic	Foreign
January	225,989	21,141	77,300	23,792	1,069	171
February	244,411	21,826	83,253	23,086	998	213
March	279,741	22,069	92,006	26,040	1,272	149
April	291,570	22,802	83,308	23,452	1,465	185
Four Months	1,041,711	87,838	335,867	96,370	4,804	718

\*Automobile Manufacturers Association.

# NEWS of the INDUSTRY

## Shipments of Complete Aircraft and Other Products of Aircraft Plants\*

	FIRST THREE MONTHS, 1947			
	January	February	March	Three Months
Complete Aircraft	2,277	2,013	1,922	6,212
For U. S. Military:				
Number of Planes	111	99	137	347
Value of Planes and Parts	\$38,445,248	\$42,535,288	\$34,548,763	\$115,529,299
For other than Military:				
Number of Planes	2,166	1,914	1,785	5,865
Value	\$8,591,171	\$7,520,573	\$14,393,256	\$30,505,000
Under 3,000 pounds:				
Number	2,146	1,903	1,762	5,811
Value	\$6,826,181	\$6,320,271	\$5,908,246	\$19,054,698
3,000 pounds and over:				
Number	20	11	23	54
Value	\$1,764,990	\$1,200,302	\$8,485,010	\$11,450,302
Parts for other than Military	\$1,030,375	\$1,980,699	\$1,505,629	\$4,516,703
Conversions:				
Number of Planes	28	27	20	75
Value	\$2,018,780	\$2,279,745	\$2,175,780	\$6,414,305
All other products, Value	\$3,124,847	\$1,901,245	\$2,740,397	\$7,766,489
Total Value of Products	\$53,210,421	\$56,157,550	\$55,363,825	\$164,731,796

\* Bureau of the Census and Civil Aeronautics Administration.

## '48 Models by Only Two Cos. Probable by End of Year

It now appears fairly certain that 1948 models have been delayed and probably only two companies will introduce their new models this year. Hudson is understood to be quite far along in its tooling program and possibly could get into production on its 1948 model in the last quarter of this year. The new Hudson is reported to be vastly improved but details are a closely guarded secret. Packard has already brought out its 1948 convertible model and is expected to follow later this year with a four door sedan and station wagon.

## New Styling and Large Panels Increase Die Production Cost

Aside from greatly increased labor and material costs, the nature of new dies being ordered by automobile companies is adding greatly to the expense of bringing out 1948 models. Dies for much larger body panels and for parts requiring much deeper draws than were used a few years ago require larger and more complicated dies than were normally used in the industry. Certain design changes also require the use of more dies in certain parts, as, for example, a fender which once took only two or three dies now requires six separate ones.

## Face Lifting Instead Of New Models for Some Cars

With tooling costs about triple what they were prewar, it will not be surprising to see a certain amount of face lifting on certain 1948 model cars instead of entirely new models. In fact, it is almost certain that

Studebaker and Kaiser-Frazer, which came out with their advanced styling last year, will do little in that direction in 1948. It also should be remembered that General Motors Corp. cancelled its die work on Chevrolet and lower priced models of Pontiac and Oldsmobile, and with these three lines unable to meet the demand, it is altogether likely that with some dressing-up for 1948, major styling revisions might be put off until the 1949 model year. Most likely candidates for new styling jobs in the GM line are Buick, Cadillac and the higher priced Oldsmobile and Pontiac.

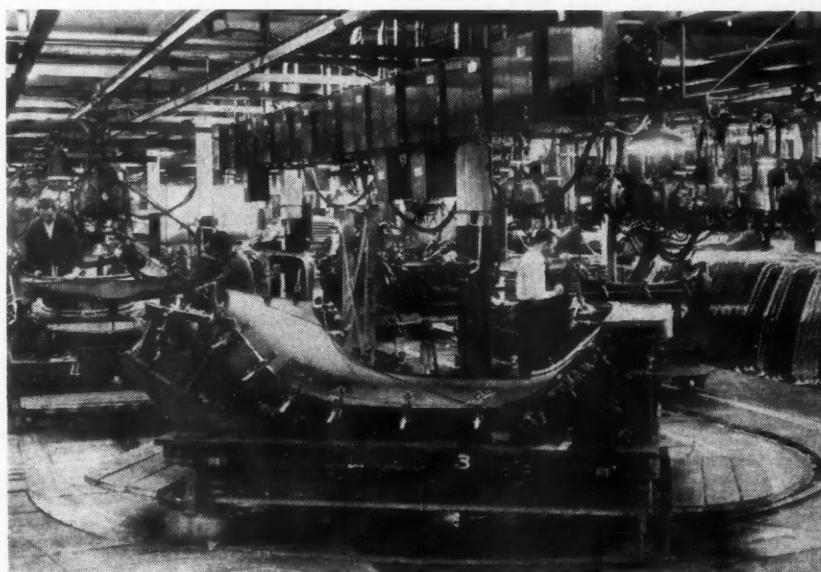
## Light Chevrolet On Back Shelf

Evidence is accumulating that the Chevrolet light car project definitely is out of the picture for a long time. Suppliers report that orders for machinery and equipment have been cancelled and that cancellation adjustments are being made. It also is known that engineering and development have stopped and that many employees have been released. It is reported that although the GM Policy Committee was in favor of going ahead with the project, members of the Finance Committee voted it down because of material shortages and high tooling and production costs. It is now believed that the project will not be revived for several years unless Ford or some other major competitor should suddenly decide to crash the market with a lower cost, light weight vehicle. In that event, Chevrolet has pretty much completed its design plans and could probably get into the field without too much delay.

## Ford Still Optimistic About West Coast Suppliers

Ford Motor Co. has refuted published reports that its project of procuring an additional \$50 million of parts on the Pacific Coast for its western plants is a failure. L. C. Disser, Ford's West Coast purchasing representative, said the company

## Merry-Go-Round at Briggs



This large merry-go-round conveyor handles structural members and components for assembly and welding in the roof panel for all-steel bodies at the Conner Plant, Briggs Mfg. Co., Detroit. This Briggs plant features a number of these conveyors.



# NEWS of the INDUSTRY

## 1947 New Passenger Car Registrations\*

Arranged by makes in descending order according to the three months' totals which include complete reports for January and February, but only 44 states for March.

	January	February	March	Three Months	
				Units	% of Total
Chevrolet	43,508	38,774	41,287	123,567	19.43
Ford	35,442	38,691	37,374	111,507	17.53
Plymouth	19,073	22,832	23,105	65,010	10.22
Buick	16,158	16,970	15,576	48,704	7.66
Pontiac	12,609	14,836	14,150	41,595	6.54
Dodge	13,325	13,466	13,106	39,897	6.27
Oldsmobile	13,811	13,061	12,300	39,172	6.16
Mercury	7,627	8,401	7,877	23,905	3.76
Nash	8,396	7,070	7,610	23,076	3.63
Studebaker	7,432	7,062	7,337	21,831	3.44
Hudson	6,646	7,324	7,673	21,643	3.40
Chrysler	6,326	6,313	6,194	18,833	2.96
De Soto	4,938	4,830	4,498	14,266	2.24
Cadillac	3,570	3,419	3,171	10,160	1.60
Packard	2,871	3,004	3,049	8,924	1.40
Kaiser	2,402	2,740	2,734	7,876	1.24
Lincoln	1,576	1,706	1,659	4,941	.78
Willys	1,324	1,429	1,311	4,064	.64
Frazer	1,158	1,417	1,475	4,050	.64
Crosley	787	918	1,075	2,780	.44
All Others	86	50	41	177	.02
Total	209,063	214,333	212,602	635,998	100.00

\*—Data from R. L. Polk & Co.

is more than satisfied with results thus far. He said that the project cannot be accomplished overnight and that much long range planning is required. Albert J. Browning, vice-president and director of purchasing, said that the company is encouraged by reception of the program and has received excellent cooperation from West Coast manufacturers. He stated that it takes approximately nine months after blueprints have been approved by the company before production actually is begun by the supplier. In February, when company representatives presented the program to West Coast manufacturers, more than 3000 companies expressed interest in becoming Ford suppliers for plants at Richmond, Long Beach, and Los Angeles, and applied for blueprints. The company reports that of the 450 quotations already received at least 65 are in line or lower than present costs of items now being purchased and that several large orders already have been placed with California manufacturers. One order for 150,000 wheels amounted to nearly \$1 million.

### Graham-Paige Plans to Move Rototiller From Willow Run

A report from York, Pa., states that Graham-Paige Motors Corp. has leased a plant there and will move its Rototiller operations from Willow Run. It is further stated that G-P will pay \$20,000 a year for ten years for the manufacturing floor space which is approximately 80,000 sq ft, with an option of buying the building anytime within that period for \$225,000.

### GM's Australian Unit Shows Loss in 1946

For the second year General Motors-Holden, Ltd., of Australia has reported a loss. The deficit just reported amounts to \$1,516,000, considerably higher than the previous year's loss of \$400,000. Low volume, higher costs, and increased investment were given as reasons for the deficit. When new plants are completed and industrial stability returns, the company will be in a position to produce greatly in excess of

its prewar capacity, the directors report. A new light weight automobile was engineered in this country and has been tested in Australia and will go into production later this year. Full output is not expected until sometime in 1948.

### AAF 64% Jet in 1948

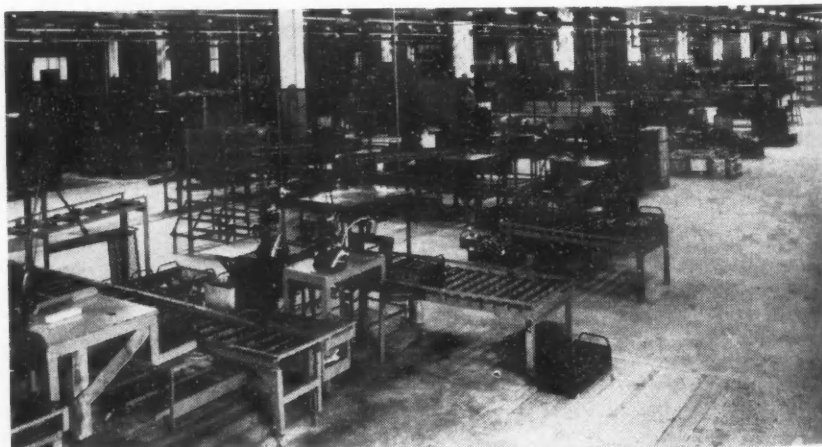
Jet propelled planes will comprise 64 per cent of Army Air Forces plane building in 1948. A large part of the \$222 million approved by the House for research and development will also be devoted to jet propulsion. Based upon the \$436 million approved by the House for new planes, estimated production for 1948 will probably total about 840 planes: 465 fighters; 140 bombers; 70 troop carriers; 30 strategic transports; 115 liaison planes and 20 helicopters. Of these, approximately 535 will be jet planes, most of which will probably be fighters.

The Republic P-84, P-85 and the P-86 are the three new fighter planes the AAF plans to purchase in 1948. These together with the B-45 and B-50 make up the total AAF combat aircraft procurement out of 1948 funds. The principal AAF fighter now being bought is the P-84, but a few P-80's are being purchased to meet attrition losses in the groups where they are now being used.

### Chilton Award to Willys

The Chilton Co. Mid-America Award Medallion for excellence in transportation engineering has been presented to Willys-Overland Mo-

### The Inside of Timken in Canada

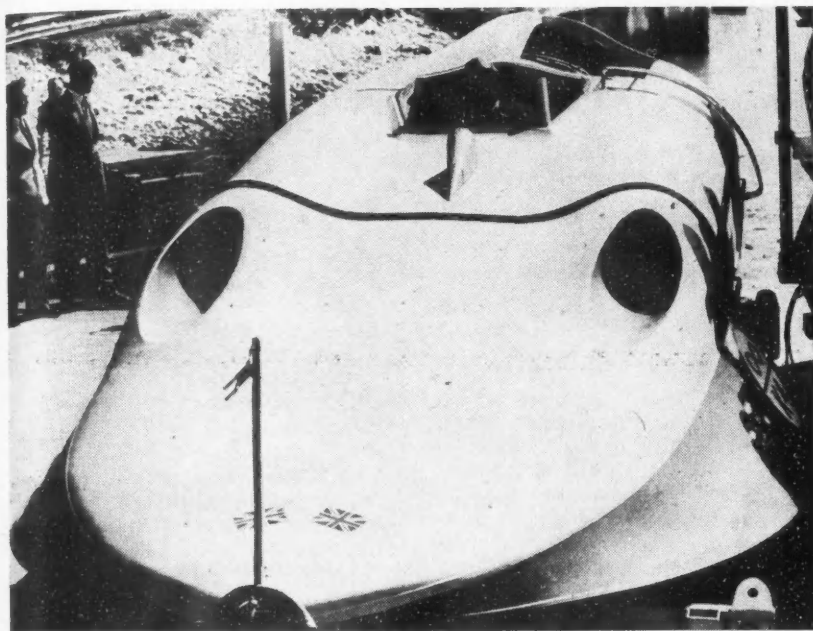


Located on a site of 70 acres, the Timken Roller Bearing Co. branch factory in St. Thomas, Ontario, is 160 by 300 ft, with an office building 40 by 140 ft fronting the plant. Initially producing completely finished bearings from screw machine parts prepared in Canton, O., ultimately bearings will be made here directly from raw materials. The equipment currently consists of grinders, lappers, special honing machines, bearing assembly fixtures, and special inspection devices.



# NEWS of the INDUSTRY

## Bluebird with a Punch



Shooting for a new world's water speed record on Lake Coniston, England in the near future, Sir Malcolm Campbell is shown seated in the cockpit of his jet-engined racing boat, the Bluebird. Powered by a Goblin II aircraft jet engine, the Bluebird's hull is practically identical with the one in which Sir Malcolm established his world's record of 141.7 mph in 1939. International News photo

tors, Inc., at the Mid-America Exposition at Cleveland. Chosen by the Cleveland Technical Societies Council and the Mid-America Exposition, Willys was cited for "meritorious engineering in the field of transportation, including rail, road, air and water; vehicles or other carriers, ways and control devices." Willys was congratulated for modifying the wartime Jeep for civilian use with agricultural and industrial applications.

## Campbell First to Use Jet to Power Boat

First use of a jet engine for propulsion on water is being made by Sir Malcolm Campbell in an attempt to beat his own world's motor boat record of 141.7 mph. A Goblin II aircraft jet engine, built by De Havilland, will replace the Rolls Royce reciprocating powerplant in the Bluebird to effect a reduction of 25 per cent in total weight of the boat.

The hull of the Bluebird, built by Vosper of Portsmouth, is essentially the same as the one which established the record in 1939. It has had to be rebuilt above the water line to house the jet engine which is

mounted centrally in the hull with two air intakes to left and right of the slipper shaped boat and ejection astern on the center line. The pilot is seated in a cockpit just ahead of the engine, with a bulkhead behind him and the fuel tanks in front. This

engine weighs 1680 lb, and is said to develop 3000 lb static thrust at 12,000 rpm. Total weight of the boat, with fuel and pilot aboard, is given as 5000 lb.

The new installation was preceded by one year's work on models by Vosper in conjunction with the British Admiralty Experimental Tank at Haslar. The rudder is larger than the previous one, to compensate for slipstream loss due to the elimination of the propeller. Steering is by Arens type controls from a conventional wheel to tiller arm.

Fuel is carried in a light alloy tank of 64 Imp gal capacity, pressure being maintained by a discharge from the engine-driven vacuum pumps. The fire extinguishing system is fitted in the form of a rail running around the turbine. A red indicator automatically lights up when the temperature in the engine compartment exceeds 240 C.

## Firestone's Hanomag Finally Gets Back Home

The war saga of a German Hanomag car is over. Purchased just prior to the outbreak of World War II by the Firestone Tire & Rubber Co. for experimental purposes, the car had been shipped to Rotterdam for transportation to the U. S. when it was seized by the Nazis moving into Holland. Eventually located and identified, Firestone claimed ownership of the car and it was recently sent to Firestone in U. S.

## 1947 New Truck Registrations\*

Arranged by makes in descending order according to the three months' totals which include complete reports for January and February, but only 44 states for March.

	January	February	March	Three Months	
				Units	% of Total
Chevrolet.....	17,994	17,109	18,272	53,375	28.06
Ford.....	13,979	15,173	14,702	43,854	23.05
Dodge.....	9,172	9,275	8,946	27,393	14.40
International.....	7,254	7,308	7,517	22,079	11.61
G. M. C.....	3,713	3,724	4,098	11,535	6.06
Studebaker.....	2,258	3,228	3,117	8,603	4.52
Willys.....	2,481	2,432	2,343	7,256	3.81
Reo.....	1,127	1,025	1,000	3,152	1.66
White.....	982	910	864	2,756	1.45
Diamond T.....	756	714	699	2,169	1.14
Mack.....	520	671	536	1,727	.91
Federal.....	374	364	397	1,135	.60
Autocar.....	442	402	279	1,123	.59
Brockway.....	472	322	186	980	.52
Divco.....	332	317	305	954	.50
Hudson.....	170	314	331	815	.43
F. W. D.....	97	151	117	365	.19
Ward LaFrance.....	63	56	28	147	.08
Sterling.....	42	27	38	107	.06
Oshkosh.....	25	29	8	61	.03
All Others.....	224	202	216	642	.34
Total.....	62,477	63,752	63,999	190,228	100.00

\* Data from R. L. Polk & Co.

# NEWS of the INDUSTRY

## Car Makers Show Small Interest in Torsion Bars

Torsion bar suspensions, which were much in discussion last year, seem to have dropped out of the picture, at least so far as 1948 models are concerned. Despite General Motors Corp.'s experience with the Vauxhall and with tanks during the war, there seems to be little indication that it is considering torsion bar springing. Ford, Chrysler, and other companies also appear to have no particular interest in the suspension. Most engineers say that torsion bar suspensions are more expensive, requiring special steel, processes, and equipment, and that they do not have any particularly outstanding advantage for passenger car use that would merit the added cost.

## Hearings to Start On Automotive Excise Taxes

A Washington report says that hearings on elimination of automotive excise taxes are scheduled to start this month before the House Ways and Means Committee. The Automobile Manufacturers Association, National Standard Parts Association and Engine Rebuilders Association will appear before the Committee to present the industry's viewpoint. It is expected that the hearings will continue for many months and that any action will not be possible before the tax revision bill comes up before Congress next year.

The AMA has compiled some interesting statistics showing the heavy tax burden borne by American motorists. The 34,000,000 motor vehicles registered in the U. S. contributed an all time high of \$2.507 billion in Federal, state, and local taxes in 1946. The state gasoline tax which

took \$1.065 million was the largest single item. Federal excises were next, taking \$796 million in taxes on new car and truck purchases and sales of gasoline, oil, tires, tubes, parts and accessories. State registration fees accounted for \$551 million; highway and bridge tolls were \$80 million; and municipal and county government levies were \$15 million. Although the U. S. Government took over three quarters of a billion dollars in automotive taxes in 1946, it contributed only \$181 million for all road purposes.

## Chrysler to Vote On 2-for-1 Stock Split

Chrysler Corp. is holding a special meeting on July 8, 1947, at the company offices in Detroit in order that stockholders may consider and act upon a two-for-one split of the present \$5 par value common stock. The amendment to the Certificate of Incorporation, upon which stockholders will vote, will provide for changing the total number of authorized shares from 6 million having a par value of \$5.00 a share, of which 4,484,375 are now issued, to 15 million having a par value of \$2.50 a share.

## Douglas Buys Plant At Long Beach From WAA

The Douglas Aircraft Co., Inc. paid the War Assets Administration \$2,003,069 recently as a down payment toward the purchase of 1,375,000 sq ft of the Government-owned aircraft plant at Long Beach, Cal. Requiring ten years to complete the deal, the total price is \$7,810,413, of which \$5,452,433 is for real estate and \$2,357,980 is for equipment. Of the Long Beach plant's remaining 1,400,000 sq ft, 400,000 sq

ft is under lease by Douglas; North American Aviation Inc. has 500,000 and Kaiser-Frazer Corp. has 500,000.

## Czechoslovakia Producing Cars & Trucks in 7 Models

Czechoslovakian factories are now producing four types of passenger cars and three truck models, not, however, in sufficient volume for export. The passenger cars being produced at Mlada Boleslav near Prague and Koprivnice on the Moravian-Slovakian frontier are the Jawa Minor, two cylinders, 20 hp; the Popular, four cylinders, 40 hp; the Tatra 57, four cylinders, 45 hp; and the Tatra 87, eight cylinders which prewar developed 70 hp at 3100 rpm. Ranging from a four cylinder, 52 hp one-and-a-half ton model to a twelve cylinder, 145 hp nine ton model, the trucks are all being manufactured at Skoda plants at Letnay, Koprivnice, and Prague.

## 5 Million Cars and Trucks Still Possible This Year

Not much is heard these days about the five million car and truck year, but there are still some men in the automobile industry that believe it may be possible. The shortage of sheet steel admittedly has reduced the chances for attaining that goal and the outlook for increased supply for several months is not good. It now is believed that the critical shortage will continue until about the last quarter of this year, barring some major economic upset that would reduce the demand from competing steel users. S. E. Skinner, general manager of Oldsmobile, said recently that General Motors Corp. is currently getting less sheet steel than it obtained in the last quarter of 1946 and is getting only 60 per

## Five Blades for Less Noise



Noise pressure has been reduced over 90 per cent in this Army Stinson L-5. Equipped with a five bladed propeller which is driven at 1000 rpm by an engine through reduction gears having a ratio of 2.8 to 1, overall noise level is reduced from 90 to 66db. Acme photo.

# NEWS of the INDUSTRY

cent of its 1941 quota. The general belief is that automotive production will not gain very much until September or October because new steel facilities have been delayed, and that during the last quarter of this year the industry probably will build cars at an all-time high.

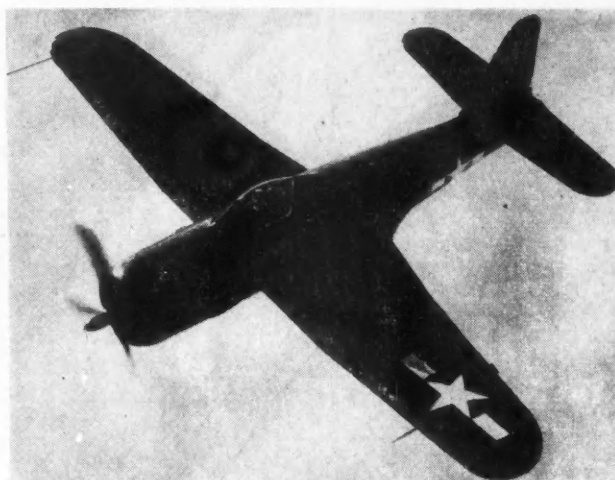
## Labor

### Incentive Pay Plan Benefits Bundy Tubing and Employees

The Cost Savings Sharing Plan at Bundy Tubing Co. still is working well, according to a company report. From April 1, 1946 through March 31, 1947 employees were paid an additional \$524,278.53 under terms of the plan. Additional benefits cited were that absenteeism dropped 43 per cent over the previous year; there was 15.8 per cent less scrap; 41 per cent less time was spent on employe grievances; and that the improvement in productivity a day was 68.4 per cent. Employees received an average bonus of 23.338 cents an hour on the basis of 2000 scheduled work hours for the year. Employees who worked full scheduled hours received a bonus of \$462.51. The average straight time hourly rate with the bonus amounts to \$1.538. The incentive plan was put into effect last year with agreement of the UAW-CIO after the company was faced with the choice of either adopting some kind of wage plan that would give greater efficiency or closing the plant.

*This Ryan XFR-4, experimental Navy interceptor fighter, powered by a conventional propeller-driving Wright Cyclone R-1820, 1300 hp front engine and a turbo-jet Westinghouse 24C axial flow rear engine reportedly has an extremely high and sustained rate of climb, and is in the 500 mph class, although actual performance figures have not as yet been released.*

## Fast Moving Experiment



### Most Automotive Companies Avoid 15-cent Pattern

Although several weeks have elapsed since the setting of the so-called "15-cent pattern" in the automotive industry, the bulk of automotive parts manufacturing companies have not yet acceded to that pattern. A few of the larger parts companies have granted the 15-cent increase but in return have asked, and in most cases have obtained, strict discipline clauses and reduction of the load of non-working paid time for union agents, according to Frank Rising, general manager of Automotive and Aviation Parts Manufacturers, Inc. A few agreements for lesser amounts have been settled by some of the smaller companies on the basis of 6½ to 10 cents an hour. One offered four paid holidays in addition. Actually, one company was able to bring about some reductions in certain operations by retiming jobs which obviously were far out of line.

### Court Backs Timken In Discipline Dispute

In a significant decision the U. S. Circuit Court of Appeals at Cincinnati has ruled that the NLRB cannot force an employer to negotiate a dispute over disciplining of employees when such disputes are not covered in the existing contract. The Court reversed a NLRB ruling against Timken Roller Bearing Co. at Cleveland which had refused to negotiate a disciplinary action until United Steel Worker strikers returned to work under the no-strike clause of their contract.

## Metals

### Copper

The first easing indication in the copper market abroad was the reported copper purchase by the British Ministry of Supply of several thousand tons recently for the equivalent of 23.25c a pound New York. This was a half cent below the foreign price prevailing previously. United Kingdom consumers are supplied at a fixed price for a six month period, extended month by month, under agreement with the British Ministry of Supply which thus tends to dominate the world market price.

### Zinc

Consumers can obtain most grades of zinc easily with the exception of Prime Western. Galvanizers now in production on a large scale are finding it difficult to obtain sufficient Prime Western which is limited in supply by production facilities. Brass mill inventory curtailment for the vacation period and reduced order backlogs of mill products are tending to lower purchases of the higher grades of zinc. Ironically enough, because of the requirements of brass mills, plant expansion projects were mainly in the higher grades of zinc during the war.

### Lead

Production of lead is catching up with demand because of the high production rate of western producers and the summer slackening in requirements—continuing a firm lead (Turn to page 96, please)

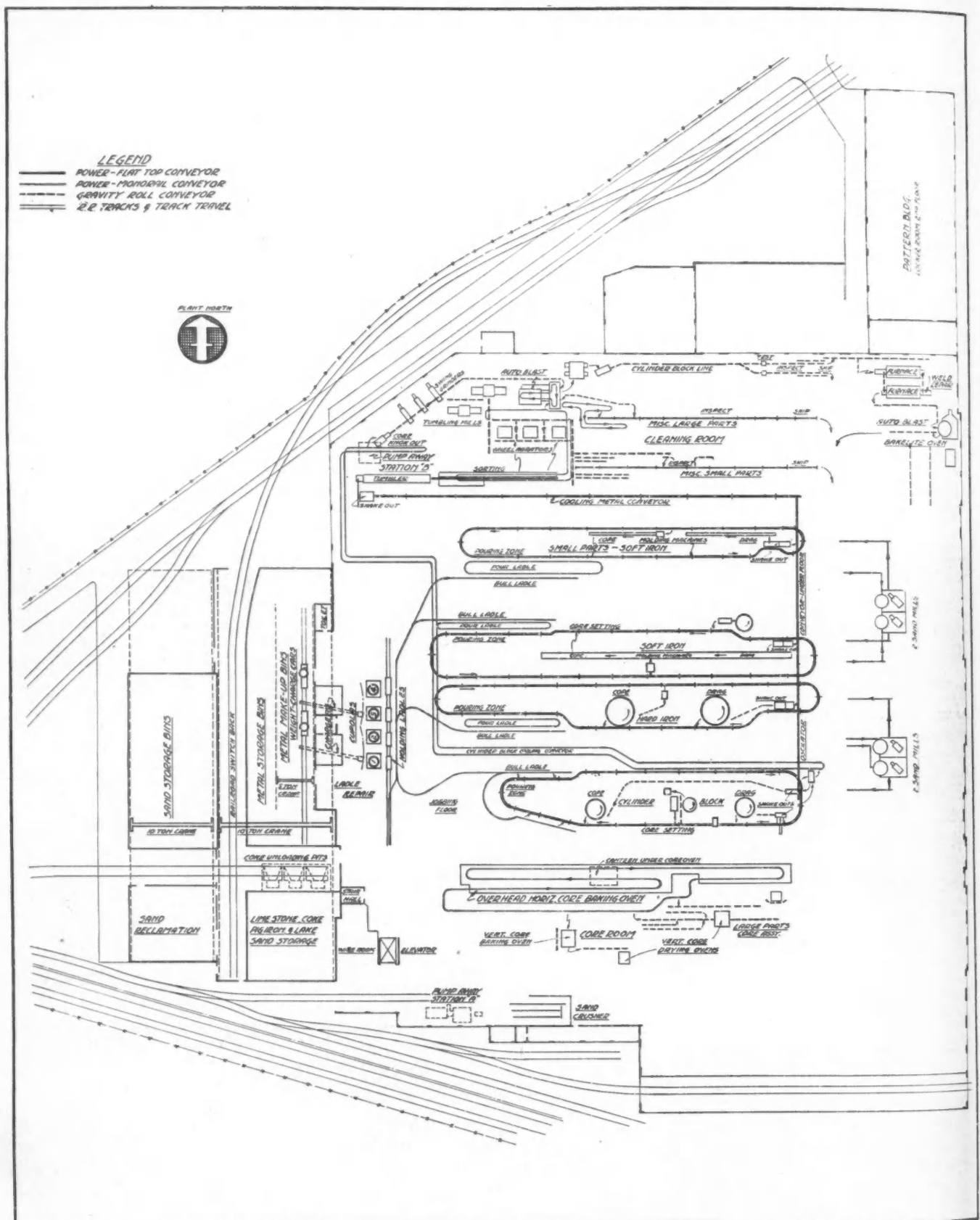
### Production of Cars & Trucks\* (U. S. and Canada)

Week ending	1947	Corresponding Week in 1941
Jan. 4	53,437	76,690
11	64,828	115,935
18	75,166	124,025
25	93,276	121,948
Feb. 1	94,114	124,400
8	89,958	127,675
15	97,276	127,510
22	103,400	127,740
Mar. 1	105,175	126,550
8	104,048	125,915
15	105,498	131,410
22	103,472	132,805
29	100,355	124,165
Apr. 5	97,385	116,255
12	97,893	99,260
19	105,337	99,945
26	102,447	108,165
May 3	101,690	130,610
10	94,756	132,380
17	83,201	127,255
24	96,651	133,560
31	77,843	106,395
Total	2,052,206	2,631,593

\* Compiled by Ward's Automotive Reports.



# Cadillac's Modernized



Floor plan and equipment lay-out of Cadillac's modernized foundry



# Foundry Facilities

By Joseph Geschelin

**R**EALIZING that the modern foundry must offer the same character of good working conditions as does a machine shop or the assembly line, the Cadillac Motor Car Division, General Motors Corp., recently unveiled its rebuilt and expanded foundry, said to rank in this respect with the finest in the nation.

It took considerable study and ingenuity to develop the floor plan, operational sequence, mechanization, and the extensive installation of equipment of the latest type within the confines of available space. Moreover, it was necessary to form into a single structure a combination of old and new buildings. In the process the roof of the older building was raised considerably to provide better ventilation. The new department has about 200,000 sq ft of floor space.

Advance planning required cooperation with engineering and metallurgical departments in the interest of maximum simplification of materials. For example, they handle only two basic grades of cast iron—a

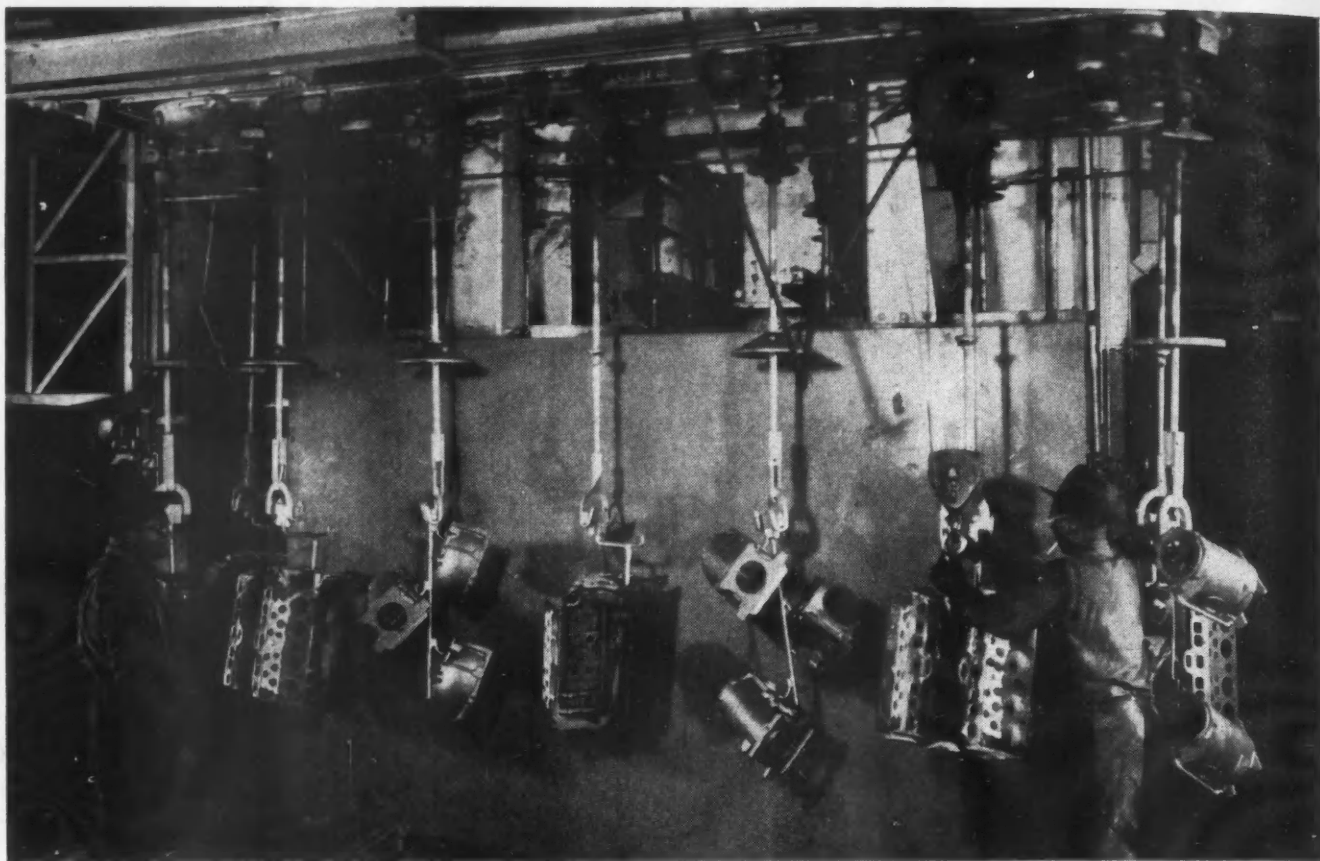
## *Ingeniously Revamped and Expanded, Highly Mechanized and Provided with Latest Types of Equipment*

“hard” iron for cylinder blocks and a “soft” iron for smaller castings. This takes care of all of Cadillac requirements and castings for the Detroit Transmission Division as well. The group of four cupolas is so operated as to have two of them melting while the other two stand by. Of the two in use at any time, one is producing “hard” iron, the other “soft.” On the basis of a melting capacity of about 16 tons per hour, per cupola on the average, the foundry produces 30 to 32 tons per hour or about 500 tons in 16 hours.

Interesting feature of cupola operation is that charging is done automatically by means of an automatic skip hoist arrangement which eliminates work-



*On the “hard” melting line. The setting and gaging of cores in the cylinder block mold is shown here*



*This is the method of loading blocks and small castings on the heavy duty conveyor for transport through the American Wheelabrator Rotoblast machine*

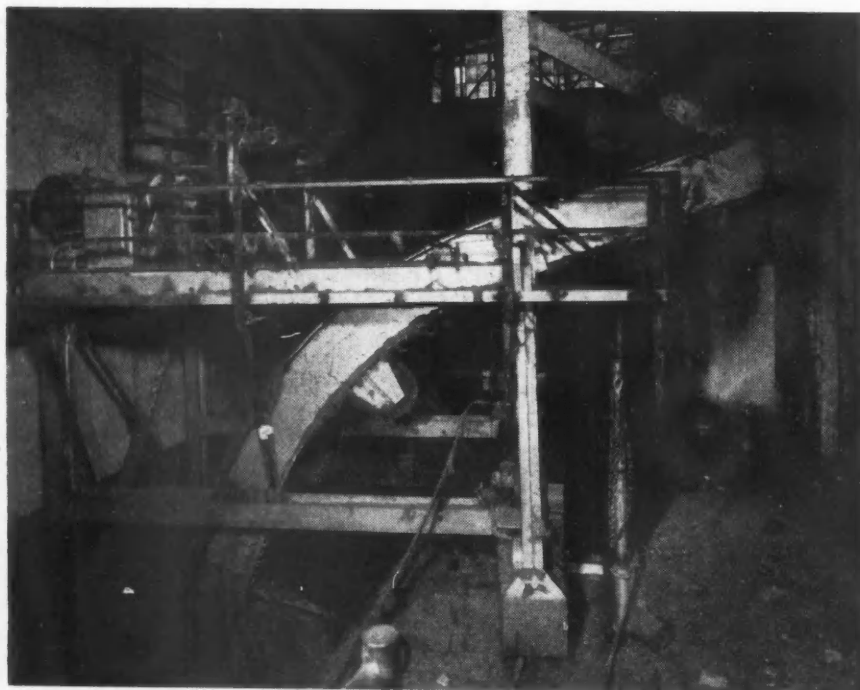
ers at the charging level, thus promoting still better working conditions.

Mechanization through the use of monorail con-

veyors, molding and pouring conveyors, hoists and cranes, and the underfloor system of cooling conveyors for small parts, contributes greatly to operating economy and to worker comfort by the elimination of most manual tasks.

Actual weather comfort comes from the installation of a comprehensive ventilation system at the ceiling and the use of exhaust hoods at all points where heat and fumes and dust are generated—on pouring lines, on shake-out stations, etc. The combination of ventilation and powerful exhaust promotes good housekeeping and working conditions approaching those in the machine shop.

The introduction of modern sand handling and sand reclaim equipment contributes importantly to the overall economy of this plant. Under ideal conditions they expect to reclaim about 70 per cent of all core and molding sand. At the present time core sand is made up of 85 per cent reclaim, 15 per cent new sand. Full realization of economy, however, goes beyond



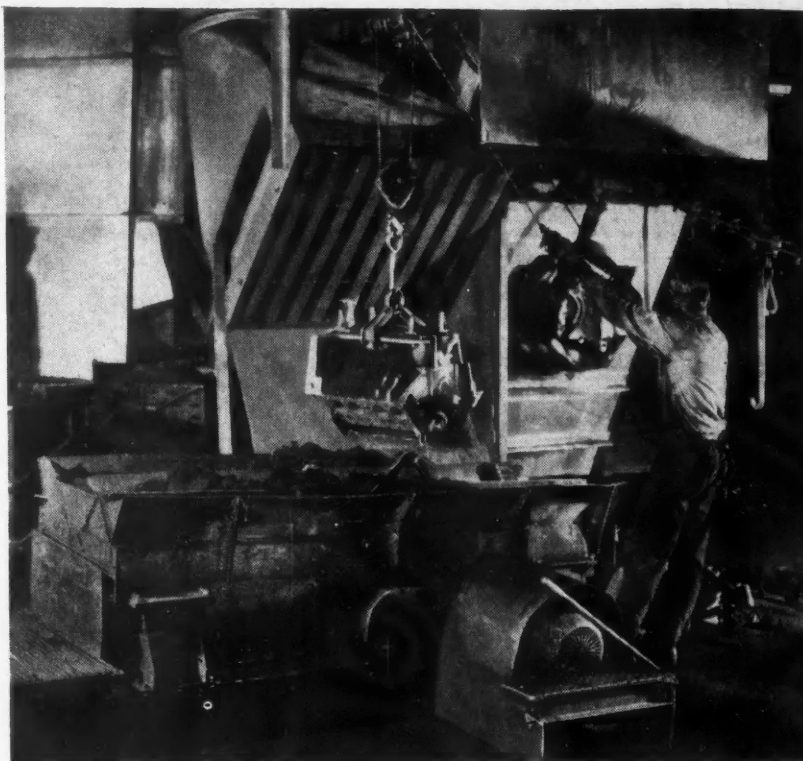
*Here is a view of the special skip hoist arrangement for automatically charging the cupola. One of the containers may be seen at the right discharging its load by dumping the floor of the container*

the saving in sand usage. Since space is at a premium, even more is gained by reducing the need for storage space, the handling of freight cars, and docking facilities.

A glance at the floor plan reproduced here will show the scheme of planning for maximum economy. Raw materials are received and stored at the west end of the building. New sand storage buildings, holding 8000 tons of sand, have unloading facilities at either end of the bins. Equipment for drying the sand is directly back of the core room.

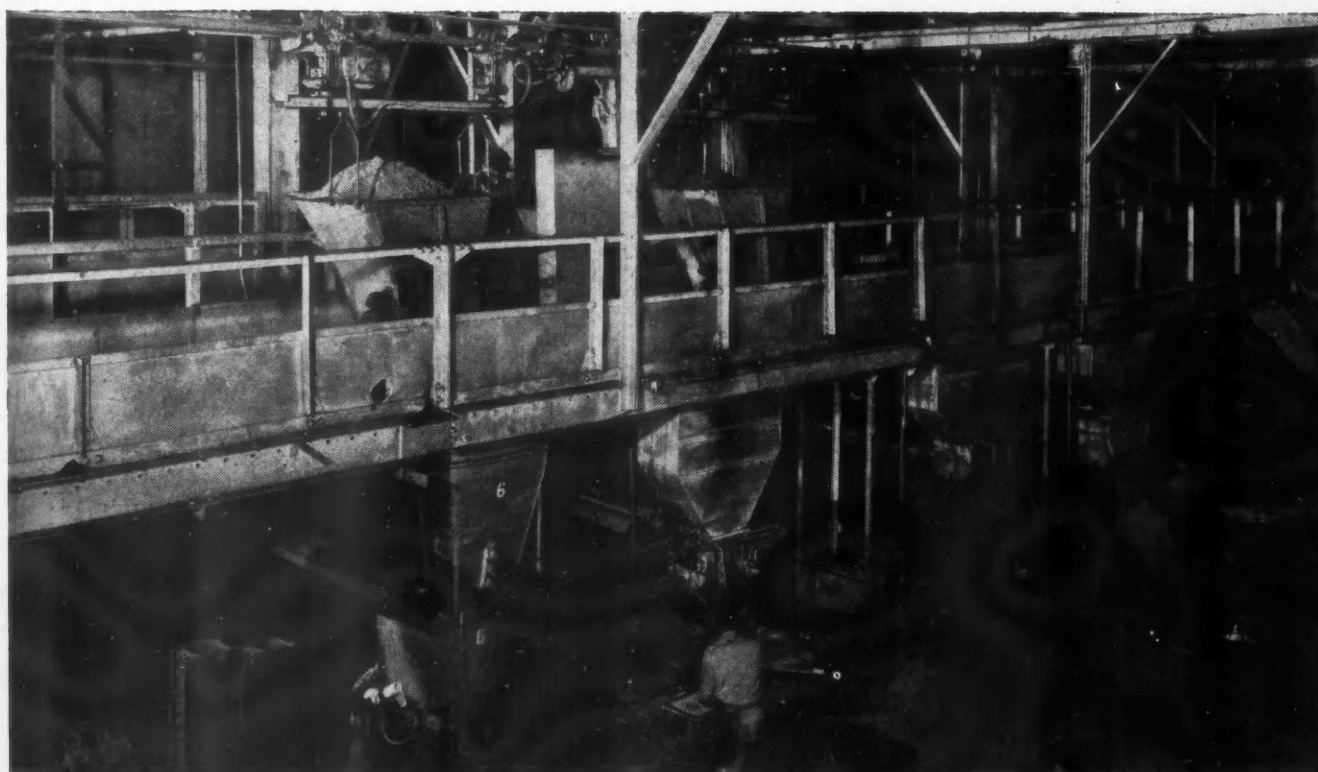
The core room and the overhead horizontal and vertical core baking ovens are at the south end. The cleaning room and inspection lines for small parts and cylinder blocks flank the department on the north.

The two "hard" lines for molding and pouring are to the south of center while the two "soft" lines are to the north. In this connection it will be noted that the cylinder block line, at the extreme south, discharges blocks at the extreme lower end at the shake-out, then the blocks travel on the conveyor through the long cooling stage which transports them to the cleaning room at the extreme right hand corner. Small parts, on the other hand, drop down onto the oscillator con-



*End of the cylinder block pouring line. The shake-out station protected by the exhaust hood is in the foreground. The operator at the right is loading a block onto the conveyor for transport through the stress-relieving oven*

veyor under the floor after shake-out and travel on this cooling conveyor to the shake-out and cleaning  
(Turn to page 72, please)



*Perspective of the sand delivery system for one of the lines in the core room. Sand is dumped into hoppers below where the cores are blown*



## Condensed Specifications—400 Series, Hall-Scott Engines (Gasoline Models) \*

Model	Bore and Stroke (in.)	Displacement (cu in.)	Comp. Ratio	Horsepower (bare engine)	Horsepower (with access.)	Maximum Torque (lb-ft)	Approx. Weight (lb)
400	5 $\frac{3}{4}$ by 7	1090	5.7	295 @ 2000	276 @ 2000	940 @ 1350	2200
480	5 $\frac{3}{4}$ by 6	935	5.7	275 @ 2200	252 @ 2200	800 @ 1250	2200
470	5 $\frac{1}{2}$ by 6	855	5.25	245 @ 2200	223 @ 2200	660 @ 1400	2200

\* With Butane fuel, horsepower and torque output average 15 per cent higher.

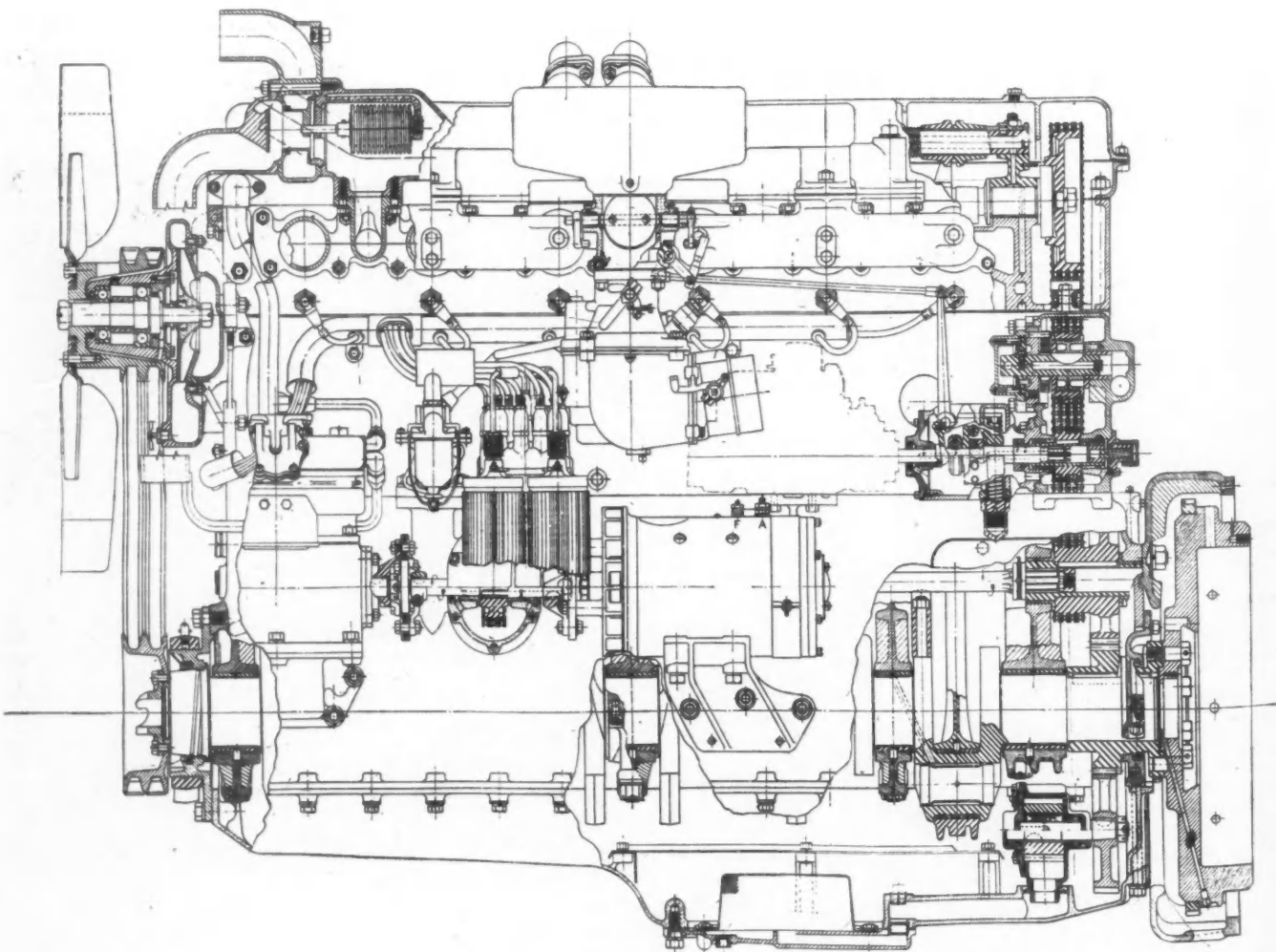
(Right) Views of the left and right sides of Hall-Scott 400 series gasoline engines. On left side is carburetor, compressor, distributor, coils, generator and governor. Right side has exhaust manifold, water oil cooler and filters. For using gaseous fuels the updraft carburetion system is replaced with a downdraft intake and primary and secondary gas regulators

**J**UST before World War II the Hall-Scott division of ACF-Brill Motors Co., Berkeley, Calif., produced a small number of its big 6-cylinder 400 series engines, a radically modified truck version of its Defender marine engine. During the war years civilian output was practically halted and production concentrated on the same engine, known as 440 model, especially adapted for use in the Army's giant tank retrievers. Technical details and drawings of the 400 series truck engines have just been released for publication.

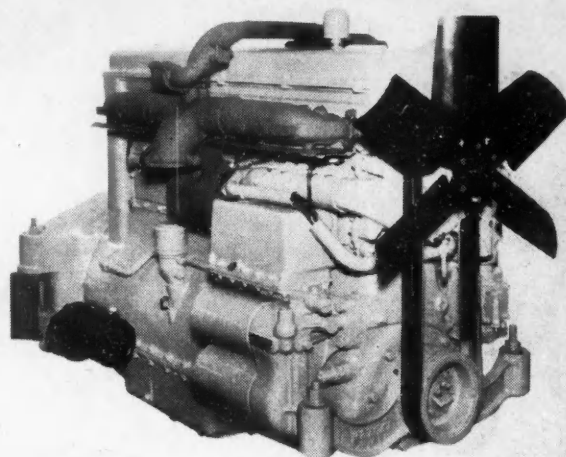
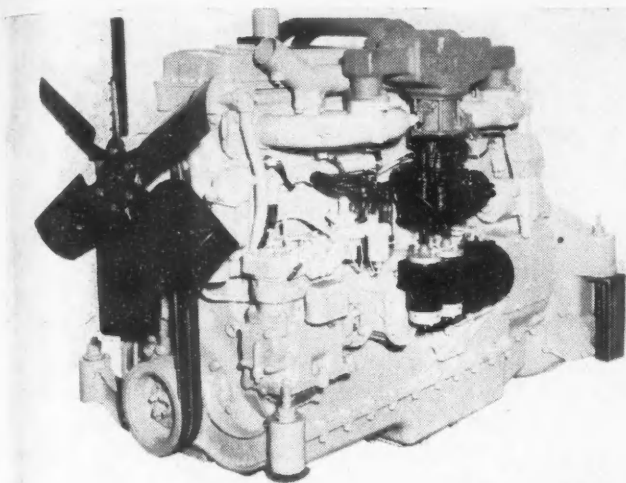
Early last year commercial production was resumed and by year's end about 350 were in use, principally on the West Coast. Production this year is expected to reach the 1000 mark and already a number of leading truck manufacturers have adopted the engine as optional equipment and in

## Hall-Scott 400

some cases as standard equipment. Some of the truck companies using Hall-Scott engines are International, Peterbilt, Mack, Autocar and Kenworth. Parts distribution has been set up on a nation-wide scale.



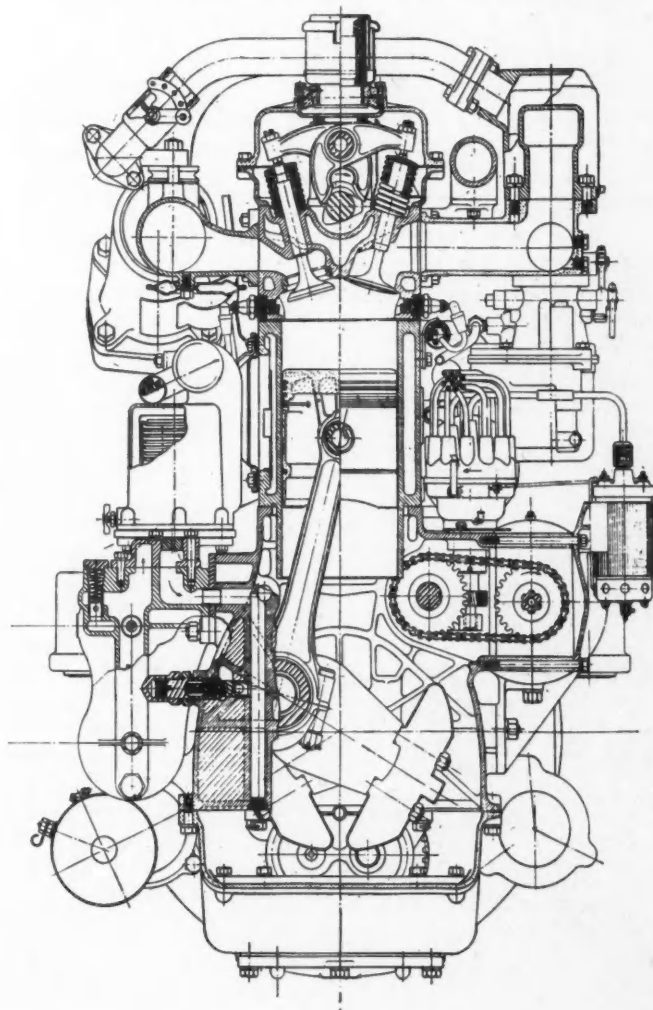
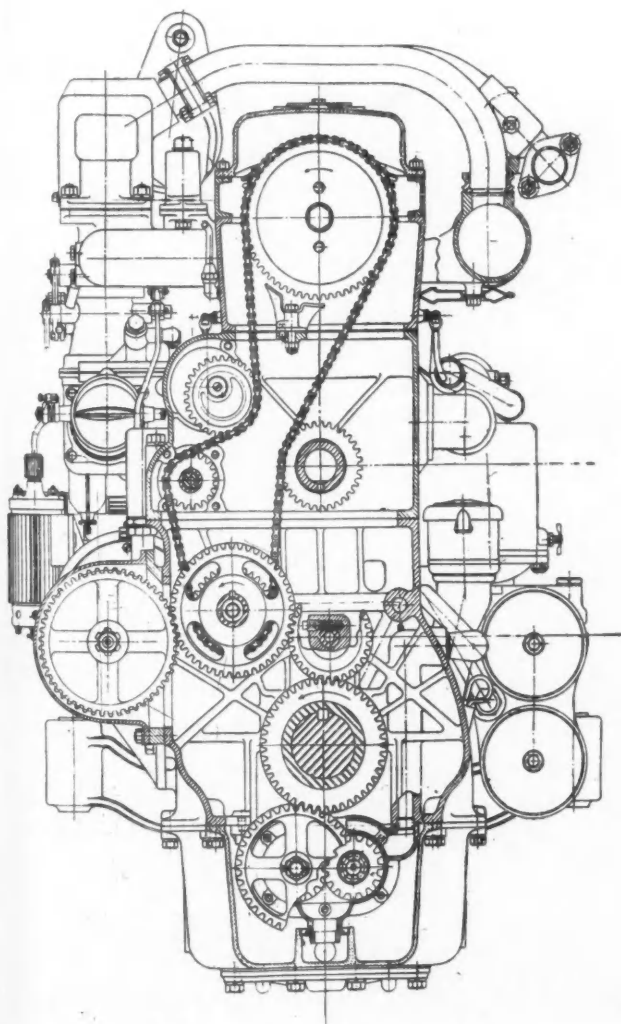




## Series High Output Truck Engines

As will be seen in the accompanying condensed specification table, the three current production models are really big, ranging from 855 to 1090 cu in. dis-  
(Turn to page 70, please)

*Drawings at the bottom of these two pages are the first to be published showing constructional details of the Hall-Scott 400 series gasoline engine. Accessory and camshaft drives are shown at the left of this page in the transverse sectional view of the engine rear. The transverse drawing at the right is through the front of the engine. Since it was made the chain drive on the accessory shafts has been replaced by an idler gear*



# Do Higher Octane

ONE of the benefits to motoring and motor traffic from engineering developments during World War II is an improvement in the anti-knock quality of gasoline. Much equipment was installed during the war for the production of high-octane aviation fuel, and some of this has become available for the production of automobile fuel. There already has been some improvement from the rather low grades of fuel marketed during the war period, and further progress is in prospect.

To take full advantage of these better fuel qualities it will be necessary to design engines with higher compression ratios. The higher anti-knock value of the new fuels gives assurance that there will be no more trouble from detonation with these higher compression ratios than there was with prewar engines operating on prewar fuels. However, detonation is not the only factor setting a limit to the permissible compression pressure. For optimum performance with the better fuels it will be necessary to give more advance to the spark, and with higher compression and a more advanced spark both the maximum combustion pressure and the rate of pressure rise will be increased. However, high rates of pressure rise are conducive to torsional vibration and also, apparently, to roughness in operation. Most current engines have a none-too-great margin of safety with respect to these troublesome phenomena, and if the compression ratios are to be further increased it will be well to check the new designs for the possibility of trouble from these causes.

There is no doubt that the likelihood of torsional vibration increases with the length of the crankshaft and, therefore, with the length of the engine. Four-cylinder engines rarely have need for torsion dampers. These dampers came into use first when six-cylinder engines were adopted for passenger cars. The advent of the six-cylinder vertical engine was followed by that of the V-eight, and relatively few models of the latter type have carried torsion dampers.

Next came the eight-in-line engine, and it is hard to conceive of an engine of this type without a damper.

The dependence of roughness in operation on engine length is less well established, since there are records of rough operation by engines with only a single cylinder. Roughness also is a form of engine vibration, but according to an extensive experimental investigation of the subject by Withrow and Fry of General Motors' Research Laboratories Division (*SAE Journal*, March, 1944, and *SAE Transactions*, Vol. I No. 1), it is a transient rather than a resonant vibration, the effect being similar to that produced by a hammer blow on a resilient body of any shape. In this case, too, it would seem that the amplitude of the vibration produced by an impulse of given magnitude, and hence the intensity of the noise, must vary inversely with the rigidity of the parts subjected to the impulse, that is, the crankshaft and the crankcase structure. It is obvious that if these parts can be shortened while the exciting forces (gas pressure and inertia) remain the same, they can be made more rigid without additional weight. Theoretically at least it would seem that the length of the parts subjected to the vibrating forces should be an even more important factor in the case of roughness than in that of torsional vibration. The angular deflection produced in a shaft of given diameter by a given moment varies directly with the length of the shaft, whereas the deflection of a simple

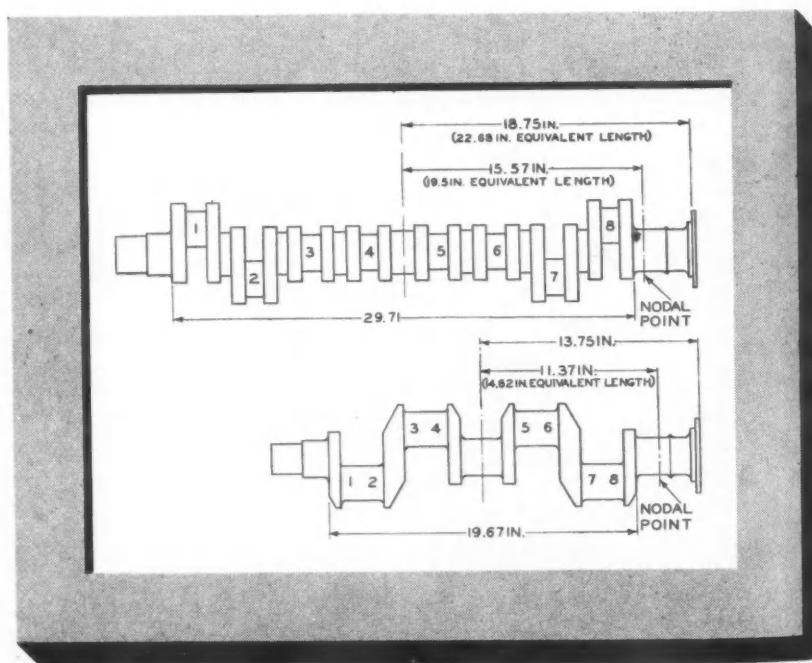


Fig. 1—Layouts of crankshafts for eight-in-line and V-eight engines of the same bore and stroke

# Gasolines

## avor the V Engine

By P. M. Heldt

beam under a given load varies as the cube of the distance between supports.

The above leads to a consideration of the relative merits of the eight-cylinder in-line and the V-eight engine under conditions where extra high compression ratios are contemplated, and the problem of there relative tendency to torsional vibration. Torsional vibration is likely to occur when any particular harmonic of either the gas-pressure or the inertia force is in phase on all of the crank throws. The torsion moments acting on the crankshaft are then symmetrically distributed along the length of the shaft with respect to the midpoint of the center bearing, and may be replaced by a single moment acting at this point. There will be a nodal point, where the shaft rotates at uniform angular speed and therefore does not vibrate, some distance ahead of the flywheel. In a conventional crankshaft assembly carrying a flywheel at the rear end and only a relatively small mass, such as a chain sprocket, at the forward end, the node usually is located from two to three in. ahead of the flywheel flange, and therefore somewhere along the length of the rear main bearing. The stress produced by torsional vibration is a maximum at the nodal point. Owing to the distribution of the exciting forces, the whole length of the shaft from the most forward crankpin to the flywheel flange will be subjected to torsional deflections, but the maximum stress developed (at the node) will be the same as if the entire torsion moment acted at the midpoint of the center bearing. This would "wind up" that portion of the crankshaft between the midpoint of the center bearing and the nodal point, with the torsional deflection produced and the resulting stress in the shaft at the node directly proportional to the torsional moment and inversely proportional to the torsional stiffness of that section of the shaft. Since the crankshaft consists of a number of dissimilar parts (crankpins, main journals and crank arms) its stiffness cannot be expressed by a simple formula, and it is therefore customary to express it in terms of the stiffness of an "equivalent length" of a plain shaft having a diameter equal to that of the crankshaft main journal. The "equivalent length" referred to is a length of plain cylindrical shafting of the same diameter as the main journal which, when subjected to a given torsion moment, will

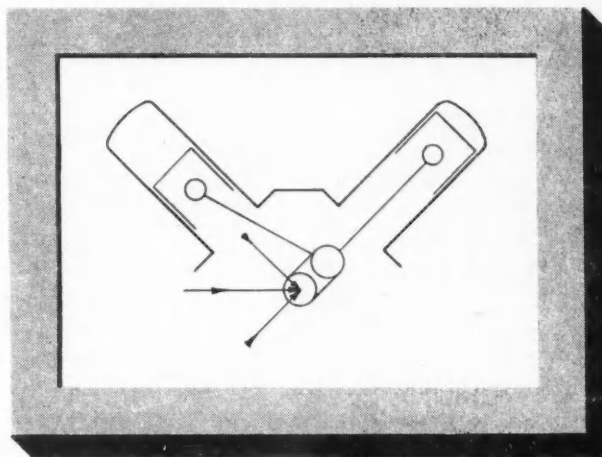


Fig. 2—Crank-train diagram

show the same angular deflection as a section of the crankshaft when subjected to the same moment.

In the following an attempt will be made to compare the torsional stiffnesses of substantially equivalent eight-throw and four-throw crankshafts for eight-cylinder engines, the former for an in-line and the latter for a V engine. Calculation of the torsional stiffness of a multi-throw crankshaft is a rather involved process. Such a calculation for a four-throw crankshaft of a V-eight engine is carried through in detail in my book on High-Speed Combustion Engines, and I will use that example here for the comparison, which will simplify matters. A further simplification is made possible by assuming that the end portions, beyond the front and rear main bearings, are exactly alike in the two crankshafts. A side view of the crankshaft for which the torsional-stiffness calculation was carried through is shown in Fig. 1. This crankshaft happens to be of the single-plane type, instead of the two-plane now generally used in V-eight engines, but that would not affect the torsional properties materially, as all axial dimensions would be the same, and also the masses of the pistons, connecting rods, crankpins and main journals, the only difference being in the crank arms and counterweights. The crankshaft



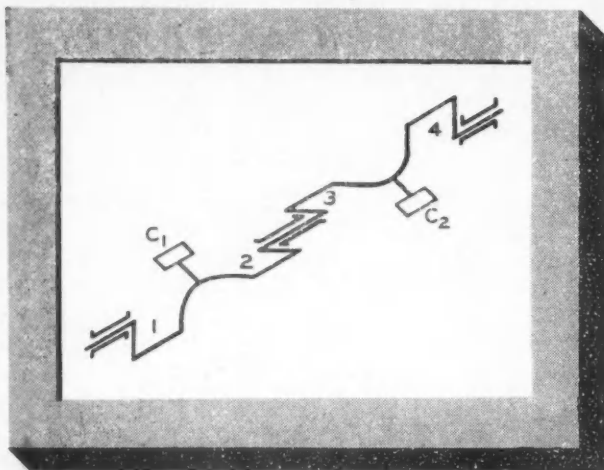


Fig. 3—Diagram of two-plane crankshaft for V-eight engine

shown in Fig. 1 was used in a stock V-eight engine of 3.4375 in. bore and 3.375 in. stroke.

In the upper part of Fig. 1 is shown a layout of a crankshaft for an in-line engine of the same cylinder dimensions. The drawing shows a nine-bearing crankshaft, though the five-bearing type is in more extensive use. This, however, also should make little difference, since in the five-bearing shaft the long arms would be designed to have approximately the same torsional stiffness as the two short arms and intermediate main bearing in the nine-bearing type. The nine-bearing crankshaft of Fig. 1 is designed in accordance with the latest rules for the proportioning of such shafts.

It will be seen that the "equivalent length" of that portion of the crankshaft for the V engine between the midpoint of the center bearing and the nodal point is 14.62 in., whereas in the crankshaft for the in-line engine it is 19.50 in. The comparison would be even more in favor of the four-throw crankshaft if the main-journal diameters were the same in both. Actually this diameter is 2.375 in. for the short and 2.70 in. for the long shaft. Crankpins are of the same diameter in both. If the main journals of the long shaft were of the same diameter as that of the short one, the "equivalent length" of the former would be 28.5 in.

Under a certain moment the longer, more flexible shaft will deflect more, and as under resonance conditions energy is imparted to the vibrating mass during each cycle in proportion to the angular deflection or amplitude of the vibration, torsional vibration will build up more rapidly and attain greater amplitudes in the long shaft. It is with the object of limiting the torsional deflection and the stress at the nodal point that the main journal of the long shaft is made of larger diameter. It is, of course, quite possible to use an equally large journal diameter in the V engine and thus ensure a greater margin of safety against vibration troubles.

Looking at the problem from another angle, the natural frequency of vibration of the crank assembly varies directly as the square root of the torsional stiffness and inversely as the square root of the polar moment of inertia of the assembly. Thus if the torsional stiffness is materially increased by reducing the length of the crankshaft, the natural frequency of the

assembly will be increased and a certain harmonic of the gas-pressure forces, which with the longer more flexible crankshaft would fall within the range of operating speeds, might be moved to a point outside that range.

That roughness is influenced by the combustion pressure was shown by the experiments of Withrow and Fry already referred to. A single-cylinder test engine ran relatively smooth when the spark plug was located at one side of the flat-cylindrical combustion chamber, but became rough when the plug was moved to the center of the cylinder head. With ignition taking place close to the center of the combustible charge, the flame could spread out in all directions with the result that combustion proceeded and the cylinder pressure rose at a more rapid rate. A similar effect would be expected from an increase in the compression ratio, especially if the latter were accompanied by a further advance in the ignition point. Thus an increase in the compression ratio might lead to objectionable roughness. Quantitatively the roughness would be measured by the amplitude of vibration of the parts most affected and by the noise level. The design factors that limit the amplitude of vibration are the transverse stiffnesses of the crankshaft and crankcase. Since with the in-line engine these parts are roughly 50 per cent longer than with the V, naturally they are not nearly as stiff. As regards the crankcase, further stiffness could be provided in the V engine by using slightly heavier sections, which could be done without equalling the weight of the much longer in-line engine.

From the practical or economic standpoint the V engine also has the advantage over the in-line type. It requires much less space on the chassis and therefore permits greater body space for a given length of wheelbase, or a shorter wheelbase for given body space. Referring to Fig. 1, it can be seen that for a cylinder bore of 3.4375 in. the V engine can be almost exactly 10 in. shorter than the in-line type. Hence a 115-in. wheelbase chassis with a V engine could take the same body as a 125-in. chassis with an in-line engine. Actually there is somewhat less difference between the two wheelbases due to the fact that with V engines there is less need for cramping the parts

(Turn to page 62, please)

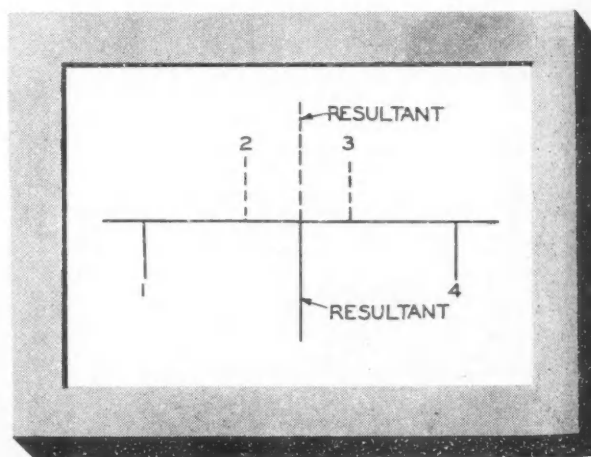


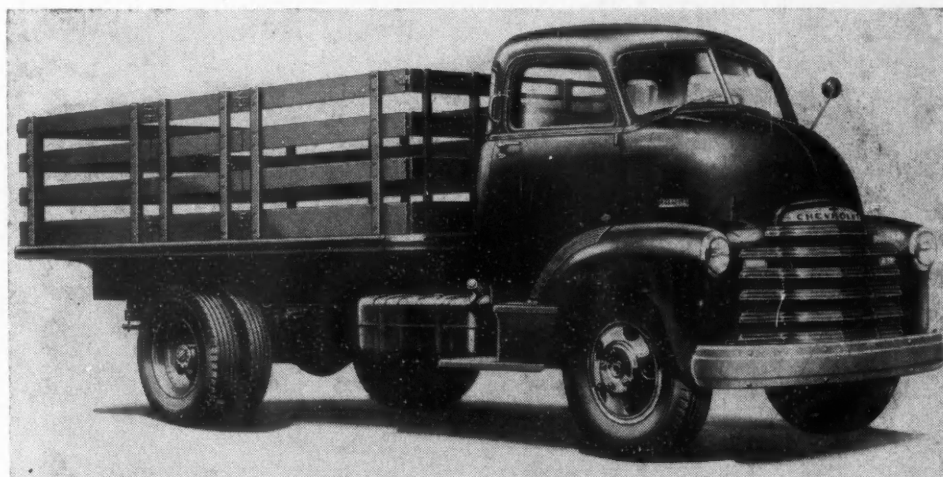
Fig. 4—Diagram of secondary inertia forces due to reciprocating parts of one cylinder bank



# Chevrolet's New Trucks

*Outstanding Changes Consist of Longer Wheelbases, Higher GVW Ratings, Increased CA Dimensions, New Cabs, Bodies and Front End Sheet Metal*

**T**HE Chevrolet "Advance Design" trucks now being announced, feature new cabs, redesigned frames, increased CA dimensions, and a special flexible cab-mounting which is said to eliminate all effects of chassis vibration and frame weave. The new line consists of the Thriftmaster (series 3100, 3600 and 3800) and the Loadmaster (series 4000, 5000 and 6000). Specifications of these models are shown in the accompanying table. Utility of the conventional heavy-duty trucks has been widened by an increase in maximum GVW ratings. For example, the maximum GVW rating of 6100 S and 6400 S trucks, the 1½ ton Specials, has

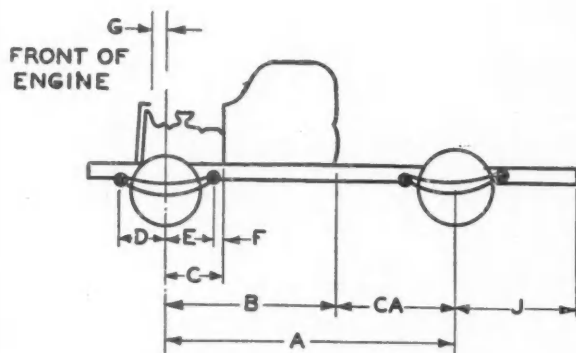


*The Loadmaster COE 2-ton long-wheelbase stake model.*

been increased from the former 14,000 lb to 15,000 lb; and the ratings of series 6100 and 6400 trucks have been raised to a maximum of 16,000 lb.

The two familiar Chevrolet valve-in-head engines power this line. The standard 216.5 cu in. engine is used in the series 3000 and 4000, and the heavy-duty 235.5 cu in. engine in series 5000 and 6000. The larger engine is offered as optional equipment in the 4000 series.

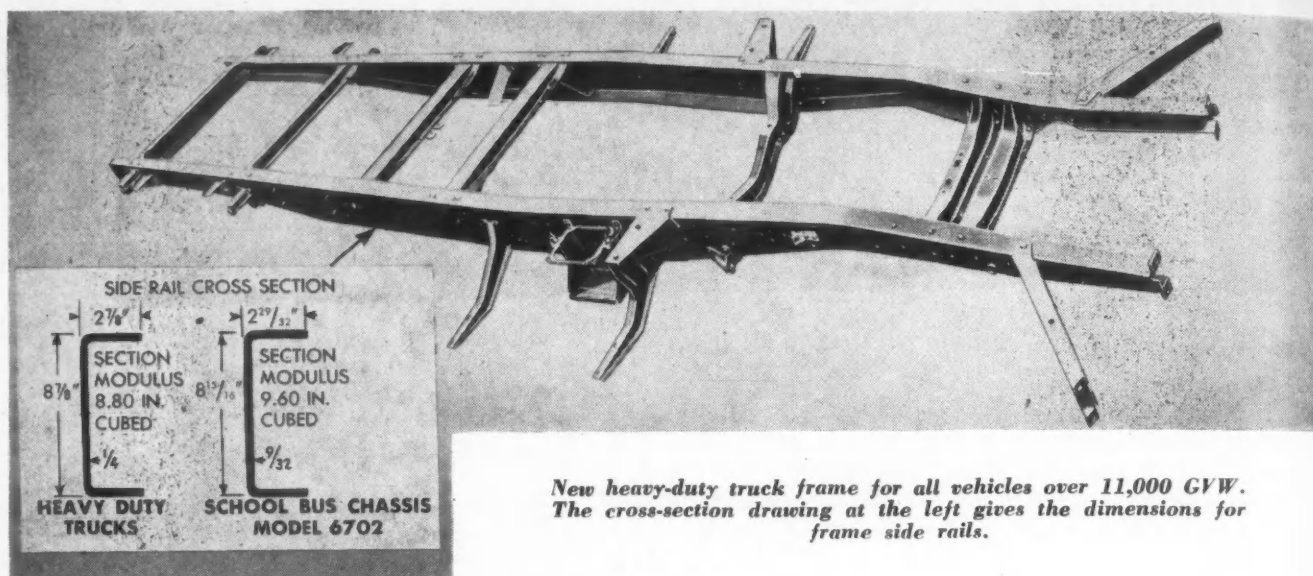
Some noteworthy detail changes have been incorporated in the engines. The oil rings are of wide slot design and are thus less susceptible to plugging



**Dimensions of Chevrolet "Advance Design" Trucks and Their Dimensional Changes Compared with Preceding Series**

Item	3100		3600		3800		4100		4400		4502		5100		5400		6700		6100		6400		6702	
	Dim.	Chg.	Dim.	Chg.	Dim.	Chg.	Dim.	Chg.	Dim.	Chg.	Dim.	Chg.	Dim.	Chg.	Dim.	Chg.	Dim.	Chg.	Dim.	Chg.	Dim.	Chg.	Dim.	Chg.
A	116	+1	125¼	0	137	+2½	137	+2½	161	+1	161	+1	110	+1	134	+1½	158	0	137	+2½	161	+1	199	+4
B	77	0	77	0	77	0	77	0	77	0	—	—	49⅞	+3	49⅞	+3	49⅞	+3	77	0	77	0	—	—
C	17¾	-3	17¾	-3	17¾	-3	17¾	-3	17¾	-3	17¾	-3	-9¾	0	-9¾	0	-9¾	0	17¾	-3	17¾	-3	17¾	-3
D	19	+2	19	+2	—	0	—	0	—	0	—	0	—	0	—	0	—	0	—	0	—	0	—	0
E	19	0	19	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
F	—	-3	—	-3	—	-3	—	-3	—	-3	—	-3	—	0	—	0	—	0	—	-3	—	-3	—	-3
G	—	+3	—	+3	—	+3	—	+3	—	+3	—	+3	—	—	—	—	—	—	+3	—	+3	—	—	+3
CA	39	+1	48¼	0	60	+2½	60	+2½	84	+1	—	—	60½	-2½	84½	-1½	108½	-3½	60	+2½	84	+1	—	—
J	38½	0	38½	0	—	—	—	—	—	—	71⅞	-13⅜	—	—	—	—	—	—	—	—	—	—	94¼	+9⅞

Dim. — Dimension Chg. — Change in Dimension + — Increase — — Decrease 0 — No Change



with carbon. The water pump features a double-row ball-bearing mounting for the shaft, permanently sealed and lubricated. The seal is new, of asbestos and Bakelite construction, and is said to give about twice the former life. The cooling system capacity has been increased from 14 to 15 qt on the light-duty models and from 16 to 17½ qt on heavy-duty models. The clutches of these engines are rated at 200 lb-ft torque. Three-speed synchromesh transmissions are used in the series 3100 and 3600, the others being equipped with four-speed sliding gear transmissions. The latter, also available optionally on the series 3100 and 3600, has provision for power take-off. The steering gear is the re-circulating ball nut and sector type with larger and stronger steering columns than on conventional truck models. The steering mounting is attached directly to the frame with four bolts. Steering gear ratios have been increased on all models, and all conventional models have larger steering wheels.

Except in the ½-ton model, the line features the familiar full-floating hypoid gear axle. Ratings of heavy-duty single-reduction and two-speed axles has been increased to 13,000 lb on the tires. The rear tread on the 3100, 3600, and 3800 series has been increased to allow for wider bodies. On the 3100 are rubber insulated spring seats which are said to be more dur-

able, quieter and to require no lubrication. Hotchkiss drive is standard on all models except the 3100 series, the rear springs being employed to cushion thrust and torque reaction. In the 3100, torque is absorbed through the torque tube, the drive being taken by the rear springs.

Cabs are of welded all-steel construction with more width, head room and leg room than previous models. The cab is said to seat three comfortably through an increase in seat width of eight in. Seats now are passenger-car type with a convenient regulator lever at the side for seat adjustment. Seat cushion and

**Load Capacity Chart for Chevrolet "Advance Design" Trucks and School Bus Chassis**

Type	Series	Wheel- base (in.)	CA Dimension, (in.)	Gross Vehicle Weight* (lb)	Rear Springs	Engine	Rear Axle
Light- Duty	3100	116	39	4200	8-leaf	Standard 216.5 cu in. 6-cylinder	4.11
				4500			
	3600	125¼	48¼	5200	2-stage, 7-leaf		4.57
				5200	2-stage, 8-leaf		
				5400	2-stage, 7-leaf		
Medium- Duty	3800	137	60	5700	2-stage, 8-leaf	Heavy-duty 235.5 cu in. 6-cylinder	5.14
				6100			
	4100 4400	137 161	60 84	6700	12-leaf		5.43 or 6.17
				8800			
				7600 9500 11000 13000			
Heavy- Duty	6100S 6400S	137 161	60 84	13000	6.17 HD or 2-speed 6.13 and 8.10		
				15000			
	6100 6400	137 161	60 84	13000 16000			
School Bus Chassis	4502	161	—	13000	2-stage, heavy 11-leaf and heavy-duty frame	Standard	5.43 or 6.17
				16000			
	6702	199	—	13500	2-stage, heavy 11-leaf, with brak* booster and heavy-duty frame	Heavy-duty	6.17 HD or 2-speed 6.13 and 8.10
				15000			

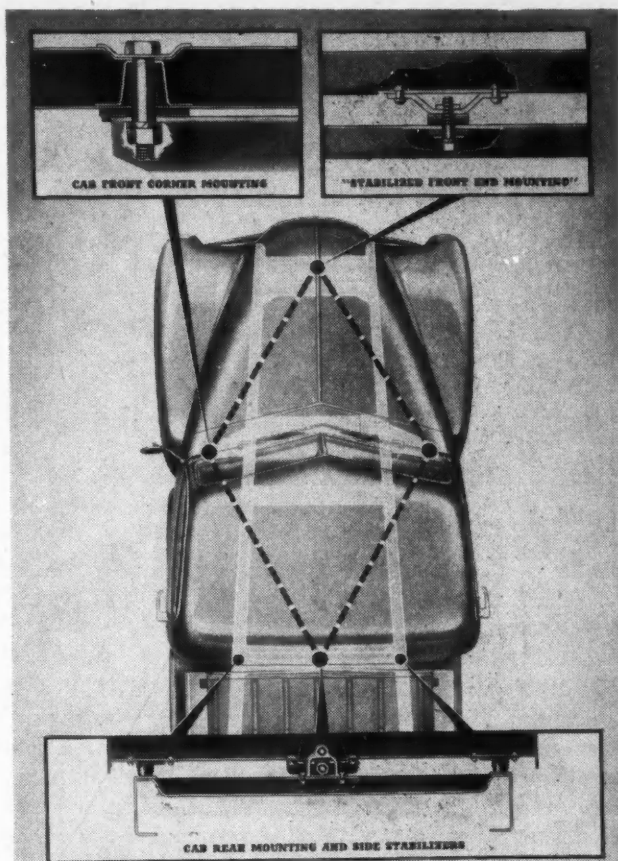
\* With regular production optional equipment, maximum GVW ratings are as follows: 3100-4500 lb.; 3600-5500 lb.; 3804-5-7-6700 lb.; other 3800 models-5500 lb.; 4100 and 4400-13,000 lb.; 4502-12,000 lb.; 5100, 5400 and 5700-16,000 lb.; 6100S and 6400S-15,000 lb.; 6100 and 6400-16,000 lb.; 6702-15,000 lb.

back move together when adjusted, the seat rising with forward adjustment to maintain a good eye level. Seat cushions feature a larger number of softer rate springs, preloaded to reduce bounce. Visibility is improved by the use of larger windshield glass set solidly in the cab structure, while new window regulators and glass run channels provide quietness and ease of window operation. Safety glass is used throughout.

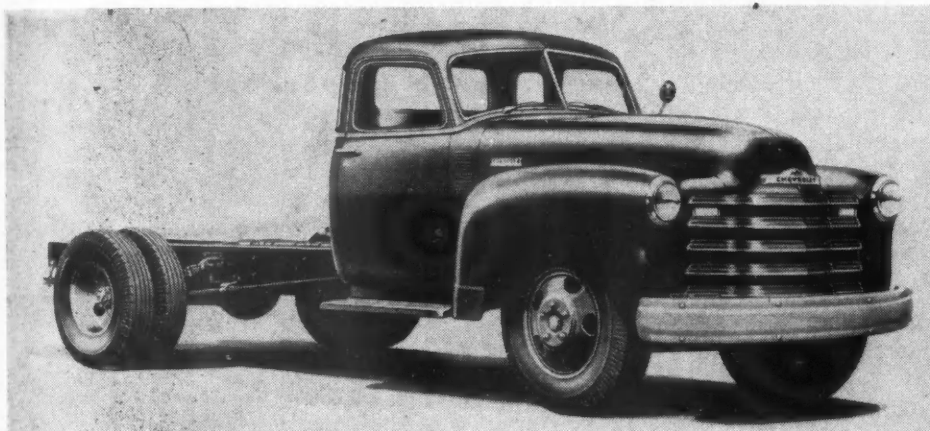
For additional driver comfort, Chevrolet has provided scoop-type ventilators on the top and left side of the cowl. Optional equipment offers a fresh-air heater and defroster unit to provide comfortable conditions in cold or rain without fogging of glass. This unit is mounted on the right hand side and draws in fresh air through a set of louvers in the cowl. The hot water supply can be shut off in warm weather to allow circulation of fresh cool air.

The special flexible mounting of the cab consists of two tension and shear mountings at the front at each corner and a shackle at the rear center. In addition the rear of the cab rests on two stabilizing rubber bumpers. The unitized front-end sheet metal assembly is mounted on a single rubber mount at the front. It is claimed that this cab suspension eliminates chassis vibration and frame weave, thus lengthening the life of the cab and sheet metal parts.

The deluxe cab is optional on conventional models. It features corner panel windows to eliminate blind

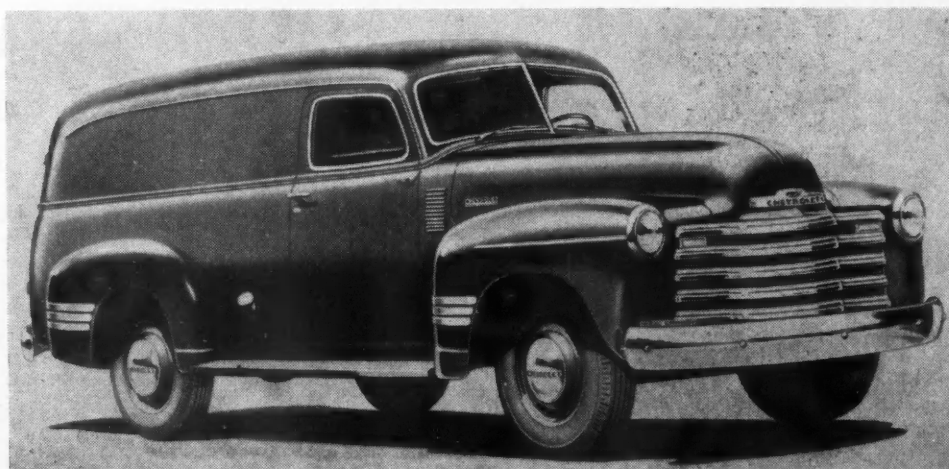


*This diagram shows the flexible mounting on the Chevrolet cab models.*



*New 1 1/2-ton chassis with deluxe cab. This chassis takes a platform, stake, stake express or high rack (Above)*

*Chevrolet's new 1/2-ton deluxe panel delivery, model 3105. (Right)*



spots, and reveal and garnish moldings of stainless steel. The corner panel windows are supplied as standard in all C-O-E cabs and may be obtained separately as an option in conventional cabs. Improved insulation, thicker dash (Turn to page 104, please)





# Specifications

**T**HESE specifications, accepted by the ASTM, cover minimum thickness requirements for electroplated coatings on significant surfaces of finished articles of steel, copper and copper-base alloys, zinc and zinc-base alloys. In the symbols used, the initial letters have been adopted as arbitrary designations of grades of plating; and the second letter refers to the base metal: S for steel, B for brass, C for copper, and Z for zinc. Specification tables are included in this article. In order to meet the specifications as to thickness of coatings, the manufacturer is advised to:

(a) Maintain regular control of all solutions and to inspect the equipment at regular intervals, paying special attention to electrical contacts and accuracy of instruments.

(b) Maintain an inspection department, using the test methods prescribed in these specifications, and in order to trace immediately the source of irregularities. On jobs running continuously over any length of time, the quality of the coatings on each part should be checked at least twice every shift, after initial difficulties have been overcome.

(c) Maintain his own requirements at least 10 per cent above those of these specifications.

Any specified thickness of plating can be produced consistently only if the current

density and time of plating are controlled. Regulation of the voltage is of no value except so far as it produces the desired current density.

The average thickness of deposit that is required to produce a specified minimum thickness of deposit will depend upon the shape of the article, the shape and position of the anodes, and the throwing power of the solution. Purely for illustration, it will be assumed that the average thickness will be 50 per cent greater than the minimum thickness. The resultant figures serve only as a rough guide and must be confirmed by trial for the articles concerned.

(a) To deposit 0.001 in. of lead with 100 per cent efficiency requires about 7 amp hr per sq ft. To produce an average thickness of 0.00150 in. (that is, 50 per cent more than the minimum thickness of 0.0010 in. specified for types E.S. and EE.S.) will therefore require about 10.5 amp hr per sq ft. This is equivalent to plating for one hr at 10.5 amp per sq ft, or for a corresponding period at any other current density. Similarly, types M.S. and MM.S. require about 5.2 and types P.S. and PP.S. about 2.6 amp hr per sq ft to deposit an average thickness 50 per cent greater

## Cadmium Coating on Steel

Type N.S.—Minimum thickness of 0.0005 in.  
Type O.S.—Minimum thickness of 0.0003 in.  
Type T.S.—Minimum thickness of 0.00015 in.

## Nickel, Copper and Chromium Coatings on Zinc (Minimum Thickness, in.)

	Type F.Z.	Type K.Z.	Type Q.Z.
Copper plus nickel, min	0.00125	0.00075	0.0005*
Copper, min	0.0004	0.0003	0.0002
Final nickel, min	0.0005	0.0003	0.0003
Chromium (if required), min	0.00001	0.00001	0.00001

\* Total of 0.0003 in. if alternative of nickel only is used.  
Note: By agreement between the manufacturer and the purchaser, copper may be omitted from type F.Z. and type K.Z. coatings, in which case the nickel thickness required shall be that prescribed for copper plus nickel. Unless otherwise agreed upon by the manufacturer and the purchaser, coatings of nickel or of copper plus nickel may be supplied under type Q.Z., subject to the thickness requirements.

# s for Electrodeposited Coatings

than the specified minimum thicknesses.

(b) To deposit 0.000015 in. of copper from a cyanide bath at 50 per cent cathode efficiency requires about 0.265 amp hr per sq ft. To produce an average thickness of 0.000023 in. (that is, 50 per cent more than the minimum thickness of 0.000015 in. specified for types EE.S., MM.S. and PP.S.), will therefore require about 0.4 amp hr (24 amp min) per sq ft. This is equivalent to plating for one min at 24 amp per sq ft or to a corresponding period for any other current density.

For complicated shapes, longer periods will be required for both lead and copper plating. When a large number of small articles are plated simultaneously (for example, on a rack or in a barrel), the time of plating must be increased to insure the specified thickness on those articles that receive less than the average current density.

## Zinc Coating on Steel

Type G.S.—Minimum thickness of 0.001 in.  
Type L.S.—Minimum thickness of 0.0005 in.  
Type R.S.—Minimum thickness of 0.00015 in.

## Nickel and Chromium Coatings on Copper (Minimum Thickness, in.)

	Type F.C.	Type K.C.	Type Q.C.
Nickel, min	0.0005	0.0003	0.0001
Chromium (if required), min	0.00001 <sup>a</sup>	0.00001	0.00001

<sup>a</sup> Chromium coatings 0.00005 in. or more in thickness are likely to cause cracking of nickel deposits on brass. An effort should therefore be made to obtain the required minimum thickness of chromium with as low a maximum thickness as practicable.

## Lead Coatings on Steel (Minimum Thickness, in.)

Type	Copper	Lead
E.S.	.....	0.0010
EE.S.	.....	0.0010
M.S.	0.000015	0.0005
MM.S.	.....	0.0005
P.S.	0.000015	0.00025
PP.S.	.....	0.00025
	0.000015	0.00025

Note: In the case of lead-coated strip and sheet, the average thickness of coating or coatings on specimens 2.25 in. sq shall not be less than the minimum thickness specified above, regardless of the portion of the strip or sheet from which the specimen is cut.

## Nickel and Chromium Coatings on Steel (Minimum Thickness, in.)

	Types D.S.	Type F.S.	Type K.S.	Type Q.S.
Copper plus nickel, min	0.0020 <sup>a</sup>	0.00125	0.00075	0.0004
Final nickel, min	0.0010	0.0006	0.0004	0.0002
Chromium (if required), min	0.00001	0.00001	0.00001	0.00001

<sup>a</sup> When copper is used in excess of a thickness of 0.0001 in., its minimum thickness shall be 0.00075 in.

# Ket's H-C Engine

## High Spots of SAE Summer Meeting

By James R. Custer

WHEN the SAE Summer meeting ended June 6, engineers left French Lick well fortified with technical data on a wide range of current engineering developments in the automobile and aircraft industries. Eighteen technical sessions were held during the week, at which 33 papers were presented and discussed by leading authorities with 165 speakers participating in the program.

Attendance at the meeting, which ranked with the most successful of the summer meetings held by the SAE, passed the 1000 mark, slightly higher than last year's figure. In addition to the technical sessions there was provided a diversified program of entertainment and recreation for the members, their wives and guests. Included again was the traditional field day of games and stunts.

General Motors Research Laboratories, Detroit, selected the meeting for announcing one of its powerplant developments—a passenger car spark ignition gasoline engine with the compression ratio (12.5 to 1) and fuel economy (0.39 lb per bhp-hr) of a Diesel. To demonstrate that this new engine has the quietness and the smoothness of a modern car engine, GMR engineers brought three 1946 Oldsmobile sixes to the meeting, one of them equipped with a regular Oldsmobile engine operating on regular grade gasoline and the other two cars with 12.5 CR engines. A large number of engineers and editors rode in the cars to compare the regular and high-compression engines.

Fuel requirement of the 12.5 CR engine is a 99 octane (research) gasoline, which some oil companies now believe they will be able to produce in the future on a volume basis to sell at about the price of today's high-test gasoline, GMR engineers state. Basically the 12.5 CR engine is conventional and when compared to the Oldsmobile six-cylinder engine, its only major design differences are the high-compression ratio, overhead valves, 24 per cent less piston displacement, seven-bearing crankshaft, and stiffer crankcase, cylinder block and head.

### More Efficient Utilization of Fuels

By Charles F. Kettering,  
Vice-president, General Motors Corp.  
and General Manager of General Motors  
Research Laboratories Div.

IT HAS been possible to build experimental high-compression spark-ignition engines operating on high-octane fuels which give as high efficiency as Diesel engines and without knock. Tests have shown that higher compression ratios present no insurmountable engineering problems. Concern over engine roughness, ignition problems, high friction, idling and other factors has been shown to be the result of carrying low-compression designs beyond their range.

A single-cylinder engine of 30 cu in. displacement was built to explore the range of compression ratios beginning at approximately 6 to 1 and extending up to 15 to 1. This engine had overhead valves in order to maintain the most effective use of the available combustion space for clearance and breathing capacity. This also kept surface to volume ratio to a minimum. Bore and stroke were 3% by 3% in. The

Charles F. Kettering, formerly general manager of the GM Research Laboratories, reviewed the history of the 12.5 CR engine development. He explained that the engine is not a production design, but was developed to show what fuel savings can be accomplished by utilizing high-compression ratios and high-octane gasolines. He proposed a long range program of cooperative research and engineering between the petroleum and automobile industries to achieve this greater fuel economy in motor vehicle operation.

Abstracts of some of the outstanding technical papers are given at the end of this article and others will appear in forthcoming issues of AUTOMOTIVE AND AVIATION INDUSTRIES.

Featured on the program were symposiums on passenger car automatic-transmission components, engine oil sludge, and cylinder wear. F. P. Zimmerli, chief engineer of Barnes-Gibson-Raymond Div., Associated Spring Corp., classified springs according to their uses and evaluated the metals suitable for them. Another excellent paper was by J. O. Almen, General Motors Research Laboratories, who analyzed the design factors for high duty gearing. Considerable interest was shown in vapor powerplants for trucks and buses, which was the subject of the paper by E. B. Neil, Columbus, Ohio, consulting engineer, who advocated a program of research to determine the feasibility of developing this method of propulsion.

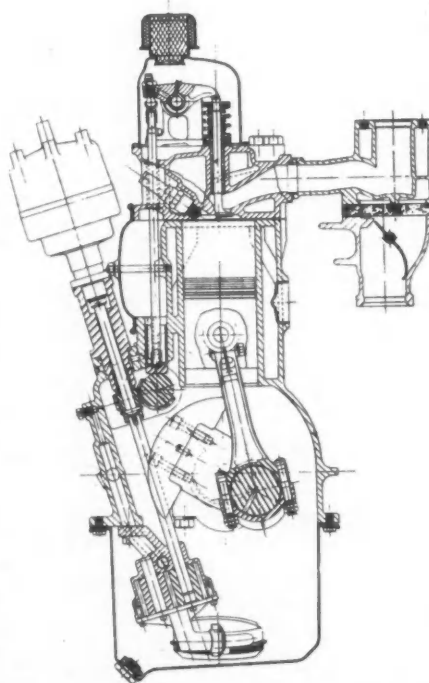


Fig. 1—Cross-sectional view of the six-cylinder high-compression engine.

engine was designed to give the required strength and rigidity for compression ratios up to 15 to 1, otherwise it was conventional in design. The compression ratio was varied from 6.2 to 1 to 15 to 1 in five steps by changes in pistons. The purpose of this single-cylinder engine program was to obtain basic data on the effects of compression ratio on performance and efficiency.

Tests were run from 1000 to 3000 rpm which was the practical high-speed limit for this particular single cylinder operation. Data obtained showed that the output increased as the compression ratio was increased, although the rate of increase became less at higher compression ratios. This was confirmation of an already well-established principle and constituted a method of determining the size and compression ratio of the cylinder which was to be used in the six-cylinder engine. Other factors which are of interest in high compression ratios and which greatly influence the mechanical design of the engine are the peak pressures obtained at various compression ratios. It was found that, as the compression ratio was increased, the peak



# and Transmissions

firing pressure increased rapidly from 580 psi at 6.2 to 1230 psi at 15. At a compression ratio of 12.5 the peak pressure was 1150 psi. These high pressures are in the Diesel range, and indicate the need for adequate rigidity if the engine is to run as smoothly as lower pressure engines.

The tests on the high-compression single-cylinder engine plus Diesel experience gave the basic data for designing and building an experimental six-cylinder engine which could be installed in a car. The compression ratio chosen was 12.5 because the single cylinder data had shown that most of the gains in efficiency on this cylinder construction could be obtained at this ratio. The plan was to build an engine which would operate at this ratio and still be acceptable to drivers as current engines. This would then show that it would be possible to use such high compression ratios in an automobile engine when high-octane fuels are at the gas station.

To give a good base line for comparison, a standard 1946 production car was chosen. The displacement of the high-compression engine was selected in accordance with the single cylinder test so that it would deliver approximately the same hp throughout the speed range as the standard comparison engine. It was also designed to be readily interchangeable with the standard engine so that it could be installed in the car without difficulty. With approximately the same hp, the same axle ratio and the same weight, the two cars should have equal performance. No weight limitation was placed on the design of the high-compression engine. The object was to provide a mechanically sound test engine in which weight could be considered later.

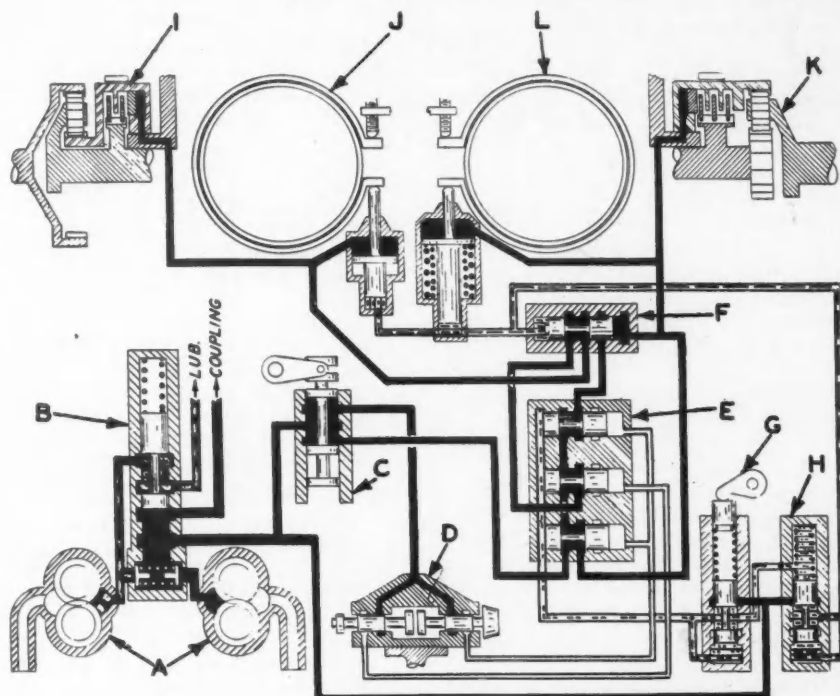


Fig. 2—Diagrammatic illustration of the Hydra-Matic transmission. The oil pumps are shown at A, pressure regulator valve at B, manual valve at C, governor at D, automatic shifting valves at E, selector valve at F, throttle valve at G, compensator valve at H, front clutch and band at I and J respectively, and rear clutch and band at K and L respectively.

Table I shows a comparison of the high-compression and 1946 stock production engines as to specifications and performance factors. While it was planned to use triptane as fuel for the early work on the six-cylinder engine, a compression ratio high enough to require triptane was not used. The ratio was chosen to obtain the greatest practical part of the gains of high-compression ratio as indicated by the single

(Turn to page 76, please)

## Automatic Transmission Control Systems

By O. K. Kelley and M. S. Rosenberger  
Transmission Development,  
General Motors Corp.

FIG. 2 shows a diagrammatic illustration of the elements of the Hydra-Matic, a four-speed automatic transmission. The system consists, first of all, of two oil pumps at A. One pump is driven by the transmission input and the other by the transmission output. The first pump maintains hydraulic control pressure whenever the engine is running, circulates oil through the fluid drive member and provides coolant and lubrication to transmission gears, bearings and friction clutches. This pump has a displacement of approximately one cu in. per engine revolution. The output-shaft driven oil pump is less than half the size of the first pump. The two pumps join their outputs into a common line through check valves and are so arranged in relation to the main pressure regulator valve, B, that whenever the smaller output driven pump is running fast enough to be able to supply the demands of the shift control system, it automatically moves the pressure regulator valve over to relieve the pressure of the larger input driven

Table I—Comparison of High Compression and Production Engine

	12.5 C R*	1946 OLDSMOBILE†
Number of Cylinders.....	6	6
Valve Arrangement .....	Overhead	L-head
Bore and Stroke .....	3 3/8 x 3 3/8	3 1/2 x 4 1/4
Displacement — cu in.....	181	238
Compression Ratio .....	12.5	6.4
Compression Pressure at 2000 rpm..	420 psi	165 psi
Peak Pressure at 2000 rpm.....	1150 psi	525 psi
Engine Torque at 2000 rpm.....	154	163
Mech. Efficiency at 2000 rpm.....	85%	81.5%
Maximum bhp .....	95 at 3600 rpm	85 at 3400 rpm
Min. Brake sp. fuel.....	.40 at 2000 rpm	.54 at 2000 rpm
Miles per Gal. at 40 mph.....	26.5	18.5
Heat Rejection to Water—Btu per bhp per min. ....	31.5	45.5
Rear Axle Ratio .....	3.63	3.63
Car Test Weight—lb. ....	4110	4110

\* Using 99 Octane (research) gasoline.

† Using regular grade gasoline.

pump. Thus in all normal driving, except at the instant of the shifts when a substantial quantity of oil is required in a hurry to fill the clutch or the band servo, the larger pump is circulating oil into the transmission lubrication system only and not absorbing excessive hp. The output driven oil pump is needed also to provide control pressure for applying the friction elements while pushing the car to start a dead engine.

The main line pressure from the pressure regulator valve is led to the control valve body. There the manual valve, C, which is the master control valve operated by the shift lever, dispatches the oil pressure to different circuits depending on whether it is set in neutral, drive range, low range or reverse. In both forward ranges the governor, D, is alive to act on the automatic shifting valve, E, of which there are three: one for low to second, one for second to third and one for third to fourth upshifts and corresponding downshifts. Both low to second and third to fourth valves control the front planetary unit of the Hydra-Matic, and there is needed an additional selector valve, F, to determine which of these two valves has access to the control circuit of the front planetary. The second and third valve controls the rear planetary unit and also dictates the position of the selector valve. In the Hydra-Matic there are really two separate shifts taking place simultaneously in the second to third shift. The rear planetary unit goes into direct and the front planetary unit drops back into reduction at the same time. The low to second valve controlling the front planetary has shifted it into direct in the one to two shift earlier. When the second to third shift takes place, the rear planetary unit shifts into direct and its clutch oil pressure reacts on the selector valve moving it over to connect the front planetary to the third to fourth valve which is still in the downshifted position. The proper timing of this selector valve is important for synchronizing these two shifts. It is accomplished by having a

variable hydraulic pressure from the throttle valve, G, act as a resistance force to the motion of this valve and the rear planetary clutch pressure to act as the shifting pressure. Thus, at light throttle, the shift in the front unit takes place at lower rear unit clutch pressure, approximating under all conditions the proper torque balance between the two units while this double transition takes place.

(Turn to page 80, please)

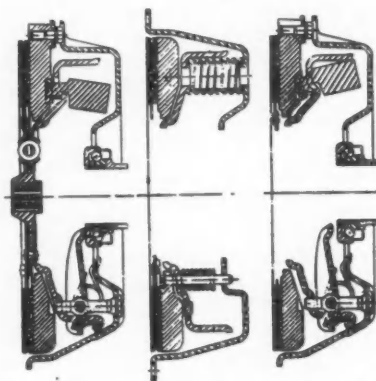


Fig. 3—These sectional drawings illustrate a mechanical centrifugal clutch for an automatic transmission.

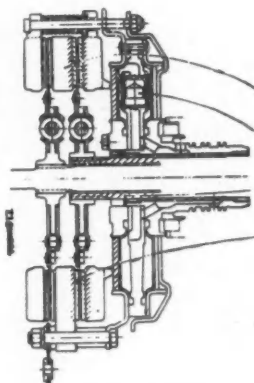


Fig. 4—Sectional view of double clutch designed for use ahead of an automatic transmission having two input members.

## Clutches for Automatic Transmissions

By Harold Nutt,  
Vice-President in charge of engineering,  
and  
Richard L. Smirl,  
Assistant chief engineer,  
Borg & Beck Div.  
Borg-Warner Corp.

A SPEED responsive friction clutch is attractive for use with automatic transmissions because of its mechanical simplicity. Also, it is free from drag when in the released position and can readily be locked solid after the transmission has shifted out of the starting ratio into one of the driving ranges. The latter feature eliminates all slip and consequently improves gasoline economy.

Fig. 3 illustrates a mechanical centrifugal clutch which has had a fairly long background of experimental development. Generally the clutch resembles a conventional foot-operated type in having the usual lever system, thrust springs and pressure plate. It will be noted, however, that the levers do not engage and pressure plate directly but operate at their outer ends against a steel stamped reaction ring which also supports the load of the thrust springs. Three equally-spaced centrifugal weights have L shaped extensions which pass through the stamping and engage the pressure plate. The heel portion of the extension rides on a hardened steel knife-edge bearing resting in a pocket in the pressure plate. The toe portion engages a strut which seats in a pocket formed in the reaction ring. For control of the speed of initial engagement, retractor springs are assembled on studs at the inner diameter of the reaction member. These springs prevent outward movement of the centrifugal weights until centrifugal force exceeds their combined thrust load. This occurs at about 700 rpm. Opening the throttle wider increases engine rpm, and at full throttle a speed of about 1200 rpm is reached at which point the torque developed by the clutch equals engine torque. When the vehicle speed in the starting ratio corresponds to the above-mentioned governed engine speed, all slip ceases.

To release the clutch at high engine speed, the pedal is operated in the usual manner. Provision for release is necessary in order to over-rule automatic engagement which may take place during the warm-up period of the engine when it is idling above the initial engaging speed. Also, when this type of clutch is used in combination with a semi-automatic transmission, a manual release of the clutch at high engine speeds is needed to change from one driving range to another.

This clutch also has an arrangement for engaging the clutch with the engine dead so that the engine can be cranked by pushing or towing the vehicle. A button on the dash is connected to a pawl interposed between the pedal and the pedal stop. Depress-

Table II—Friction Factors of Clutch Facing Materials

Type of Clutch	Friction Material	Grooves	Maximum Slip (sec)	Unit Load (psi)	Coefficient of Friction (Approx. minimum)
Dry Disc Double Clutch	Asbestos Yarn and Binder	Radial	15	40	0.21
Wet Disc Double Clutch	Soft Granular Cork	Radial and Spiral	20	45	0.16
Wet Disc Double Clutch	Medium Granular Cork	Radial and Spiral	10	70	0.14
Wet Disc Double Clutch	Woven Cotton	None	3	60	0.13
Wet Multiple Clutch	Bronze	Spiral	2	90	0.08
Wet Multiple Disc	Dense Cork and Wood Fibre	None	2	115	0.09
Wet Wrap Band, Low	Medium Granular Cork	Annular	12	120	0.12
Wet Disc	Sintered Bronze	None	15	125	0.07
Wet Wrap Band, Low	Dense Cork and Wood Fibre	Annular	1	380	0.11
Wet Wrap Band, Reverse	Molded Asbestos	Annular	1	600	0.12

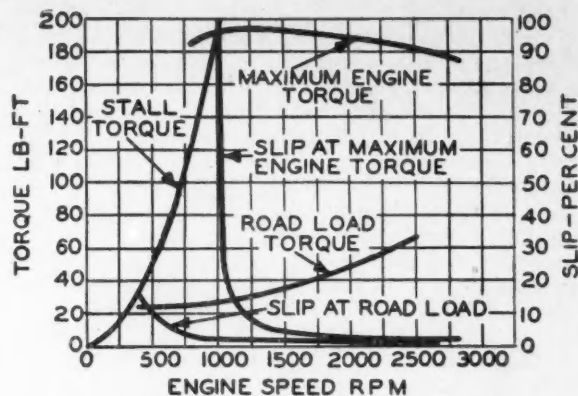
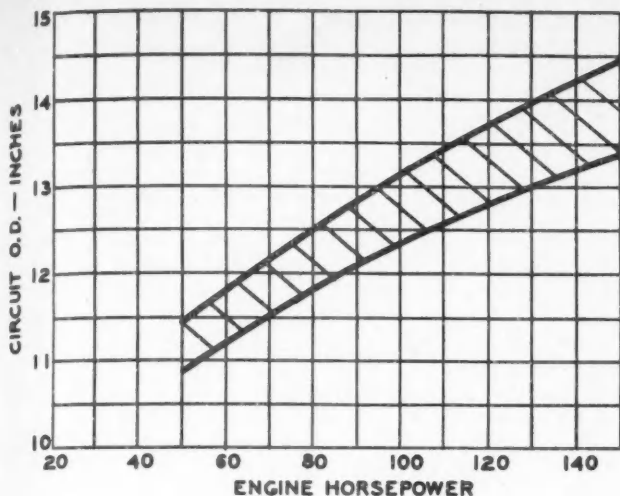


Fig. 5 (Left)—Acceptable range of fluid coupling diam for engine hp.

Fig. 6 (Above)—Characteristic performance curves of fluid coupling.

ing the pedal slightly permits withdrawal of the pawl after which the pedal can move further toward the rear, thus engaging the clutch.

Also provided is a mechanism that produces a slight drag on the drive line whenever the transmission lever is shifted from neutral to low or reverse. This eliminates initial engagement "thump" which otherwise occurs when the clutch picks up the drive line back lash. The amount of drag is not sufficient to move the car and consequently creep associated with fluid couplings and converters is absent.

A centrifugal clutch of this type requires that the pedal and release linkage mechanism be retained. The transmission with which such a clutch would be used should have at least one automatic shift ratio. This will prevent operating the car at unreasonably slow speeds in direct drive where excessive slip would take place. A down-shift to the starting gear ratio at around 12 mph has been found satisfactory. Some slip will occur in direct drive at full throttle in the speed range between 12 and 20 mph, but the amount of slip is small and not apparent to the driver or harmful to the clutch. However, in this application a somewhat oversize clutch is recommended to protect against excessive heating during long periods of slip such as might occasionally be encountered when using the clutch as a brake to hold the car from rolling backward on a steep grade or when dragging a trailer up-hill in direct drive at very low car speeds.

Fig. 4 shows a section view of a double clutch designed for use ahead of an automatic transmission having two input members. The forward driven plate is mounted on a shaft and the rear plate on a sleeve, both extending from the front end of the transmission. Each clutch is engaged hydraulically by admitting oil behind a piston sealed by a synthetic rubber diaphragm. The front diaphragm loads the rear pressure plate which is in direct contact with the rear piston. The rear diaphragm loads the front pressure plate through six pull bolts

arranged around the circumference of the cover stamping. To offset the effect of centrifugal oil pressure in the diaphragm chambers, counter-balance weights are located at three points on the periphery. Oil is fed to the annular piston chamber from a collector sleeve which telescopes into a corresponding collar on the transmission. A piston ring in each of the three narrow grooves of the collector seals the oil against excessive leakage.

Increase of oil pressure in the starting clutch is in proportion to centrifugal force exerted by a weight acting against an oil escape hole in the casting which carries the assembly. Other methods may be used, but in any case, it is essential that the amount of engagement be responsive promptly to change of engine speed so that the clutch will reduce in torque capacity if the engine falters. Otherwise the engine may stall particularly during the warm-up period.

This double clutch has possibilities with various transmission arrangements. Adaptations with countershaft gear boxes have already been tested extensively with favorable results. When arranged correctly with planetary gearing, the double clutch assembly makes a very attractive layout. On the other hand, in many designs using planetary gearings with a single input

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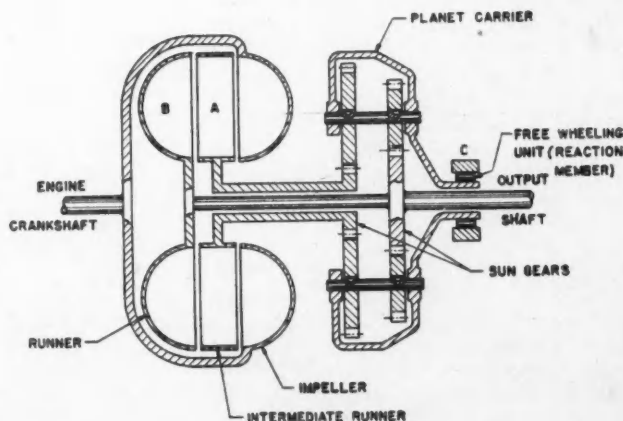
## Fluid Couplings For Passenger Cars

By A. Elliott Kimberly,  
Engineering Div., Department Head,  
Mechanical Laboratories, Chrysler Corp.

WITH the use of a fluid coupling it is possible to provide a very satisfactory step-type automatic or semi-automatic transmission which, when properly designed, and with suitable controls, leaves little in the way of performance to be desired over the continuously-variable unit. Such a combination may also be produced in volume at a reasonable cost. It is granted that this same result may be achieved by the judicious substitution of a controlled dry or wet plate slipping clutch, but the cost of controls for such an arrangement is quite often as high as the cost of the fluid coupling, and the factors of reliability, smoothness, uniformity of performance and life are certainly in favor of the fluid coupling.

An important consideration when applying a fluid coupling to an automotive drive train, in the interest of performance, is to avoid too high a polar moment of inertia in the coupling. Because the power and torque transmitted by a coupling vary as the fifth power of the diameter, the coupling must be a certain minimum diameter for the given engine and drivetrain. Often the starter ring gear is mounted

Fig. 7—Sectional drawing of a two-stage fluid coupling and interconnected gear train.





on the fluid coupling, thus adding to the inertia. With the addition of the fluid, it can be seen that the inertia allowable for the coupling circuit and housing members may be limited, thus ruling out heavier materials such as cast iron or malleable iron.

An additional requirement in fluid couplings is a minimum rotative speed without destruction or permanent distortion of the structure. Usually an ample safety factor is allowed beyond the peak operating speed of the coupling. In a typical unit of 14 in. outer diam, the fluid pressure at the periphery is 270 psi at 4000 rpm, and the total hydraulic thrust tending to separate the two halves of the unit is of the order of 24,000 lb. These forces are, of course, additive to the forces imposed on the structure due to its own mass.

When using a stamped steel or equivalent outer shell, it may be possible to use cast aluminum or one of the plastics for the circuit members, impeller and runner. On these internal members, where hydraulic pressures are practically equalized on each side and where stresses are mainly due to the masses of the members themselves, plastics or aluminum may be found feasible for use, even considering the elevated temperatures involved.

The seal between the driving and driven members in a sealed fluid coupling deserves serious design consideration. This seal is required to operate very efficiently under a wide variety of conditions, and for this reason it may be necessary to pay a premium for trouble-free service. If a face-type seal is used, a carbon and graphite sealing ring, either floating or anchored to one member, may be found to offer a satisfactory solution. Mating sealing faces are usually finished to a high degree of flatness and smoothness, which may introduce lubrication and noise problems at the sealing surfaces. Some means for permitting relative axial movement of the two sealed members must usually be provided. This can be accomplished by a bellows, or by an axially-sliding sealing member. This seal, of course, is required to operate only at the differential speed between the driving and driven members, which is quite low at cruising speeds.

In the completely-filled coupling, provision is often made for a constant flow of relatively cool oil through the unit from an outside supply, thus lowering peak operating temperatures and making less severe the operating conditions of the seal, compared to the sealed unit.

The size of the fluid coupling for a given design depends on a number of factors, including: power to be transmitted; operating speeds; type of gear train; fluid used; circuit efficiency; allowable slip at cruising speeds; percentage fill; and heat dissipation. Fig. 5 shows an acceptable performance curve for a partially-filled fluid coupling which is required to transmit full engine torque in cruising gear. Outer

circuit diameter is plotted against engine hp at wide open throttle. This chart is in the form of an acceptable range because it has been found that the power transmitting characteristics of a given coupling are sufficiently flexible to allow its use on engines within a certain hp range. This allows the manufacturer to cover his line of engines of various displacements with a minimum number of fluid couplings.

If a split power-flow gear arrangement is used, so that only part of the power is being transmitted through the fluid coupling in cruising gear, the coupling diameter may be reduced to correspond to the power actually being transmitted, provided coupling speed in cruising gear is substantially engine speed.

If a reduction in fluid coupling diameter is desirable, use can be made of a twin circuit, consisting essentially of two sets of driving and driven members, forming two independent hydraulic circuits. With this type, the diameter can be reduced approximately 13 per cent for equal power transmission and performance, at the sacrifice of greater length.

In the development of a fluid coupling for a passenger car engine, it is most useful to determine the operating characteristics on an input-output electric dynamometer set-up. As shown in Fig. 6, for a specific engine three types of curves are obtained. The first curve, on the left, shows torque transmitted by the coupling plotted against engine speed with the output member locked. This is commonly called the "stall torque curve" of the coupling. The intersection of this curve with the maximum torque curve of the engine will determine the "stall point," or the speed at which the engine will run at wide open throttle with the output member stationary. For current passenger car engines this is usually between 1000 and 1400 rpm.

The second curve plotted on this sheet is the "Slip Curve at Maximum Engine Torque," which shows percentage slip of the coupling plotted against engine speed while transmitting the maximum torque of the given engine. Slip is the difference in rpm between the driving and driven members divided by the rpm of the driver, expressed in per cent.

The third curve shows the slip of the coupling while transmitting road load torque, plotted against engine speed. Road load torque is that torque required to maintain constant speed on a level road.

From these three curves the performance of the coupling in a car can be determined fairly accurately. Inasmuch as slip percentage is also identical to power loss percentage, it is desirable to keep this figure as low as possible, other design factors being considered.

For a given circuit outer diameter, the slip may be altered considerably by variations in circuit construction. The following variables may affect slip: ID of the circuit; contour of the circuit; number, thickness, and spacing of fins or vanes; spacing between driving and driven members; smoothness and discontinuities in the circuit; fluid density and viscosity; percentage of fill; and fluid temperature.

In the event that the slip of a coupling under development is still too high after arranging these variables to the best advantage, it can be readily reduced by a small increase in outer diameter of the working circuit. Since the power transmitting ability of a fluid coupling varies as the fifth power of the circuit diameter, and since slip varies directly with the power transmitted, a small increase in diameter can result in a substantial reduction in slip.

While by far the majority of fluid couplings in use today are of the two-

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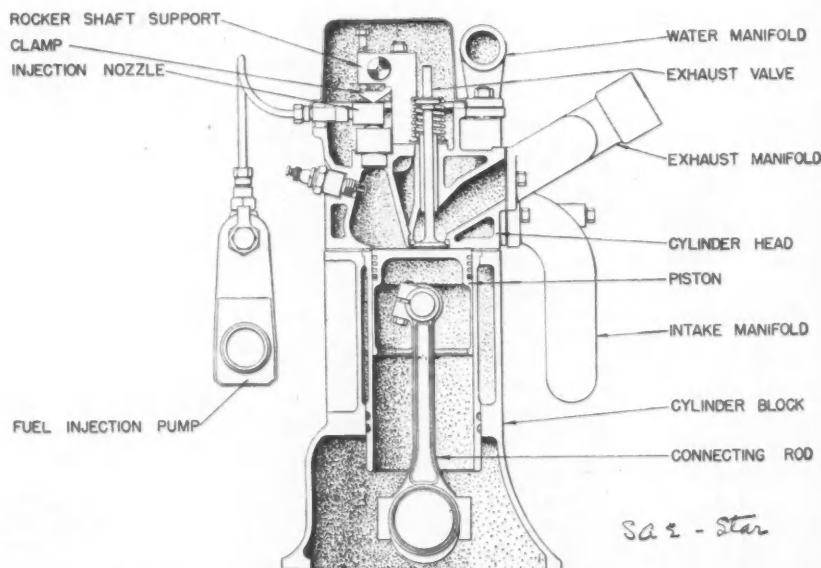


Fig. 8—Sectional drawing of the fuel-injection spark-ignition engine.

## Fuel Injection Engine with Spark Ignition

By Allan M. Starr,  
Consulting Engineer  
Starr and Sweetland.

THE chief aim in developing this engine has been to supplant the compression ignition of a Diesel engine with positively timed spark ignition and to operate at a compression ratio between seven and ten to one. The advantages attained over a compression ignition engine are easier starting, greater speed range, lighter weight, adaptability to small engines, better part-load fuel economy, and insensitivity to different fuels.

The cross-section of the cylinder head and cylinder and the general arrangement of the engine is shown in Fig. 8. The intake and exhaust valves are seated with their heads flush with the lower face of the cylinder head. The flat top of the piston comes very close to the cylinder head so that the cone-shaped combustion chamber comprises substantially all of the compression space. A fuel-injection nozzle is located at the upper end of the combustion chamber from which fuel is injected into the combustion chamber at the end of the compression stroke. A spark plug is located in the side of the combustion chamber, and a standard fuel pump is attached to the side of the engine.

The ignition spark occurs about 20 deg BTDC, and the fuel is injected just before the spark occurs. At full load injection starts about 40 deg BTDC, and as the load is decreased the start of injection is retarded. When operating at full load, detonation will occur if the spark is retarded from the normal setting, just as a Diesel will run rough if it has too much ignition delay. At the normal setting most of the fuel charge is injected before ignition occurs but there must be a time interval, after injection terminates, for a homogenous detonable mixture to develop in the combustion chamber. Hence, detonation control is dependent on the time interval during which the injected fuel drops gasify and intermix with the air.

When operating at about quarter load and less it has been found very difficult, if not impossible, to ignite and burn all the fuel charge before it gets lost in excess air. Also, at very light loads the spark plugs run too cool to stay clean. For these reasons, half of the engine's cylinders are cut out when operating at about quarter load or less. Then the cylinders that remain in operation carry sufficient load to insure clean efficient combustion. This is accomplished by a mechanism devised to control fuel pump racks which regulate the fuel metered by the pumps. Lubricating oil pressure from the engine is used to actuate the fuel pump racks, and a flyball governor linked to the fuel metering pump gives stable

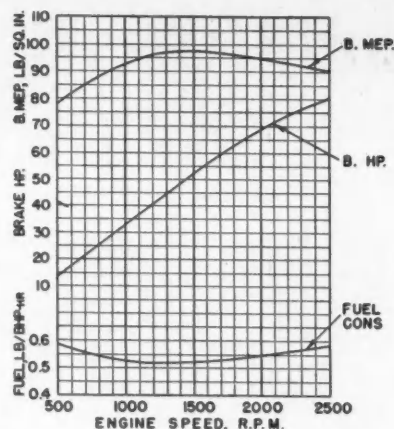


Fig. 9—These dynamometer test curves show full-load performance of the fuel-injection spark-ignition engine. Data was taken with a six-cylinder engine of 8.75 in. bore and 4.25 in. stroke using Diesel 31 API fuel with a compression ratio of  $7\frac{1}{4}$  to 1.

control throughout the load and speed range. In actual operation this control is very smooth and the change from two to four cylinders would be hard to detect if it were not for the change in exhaust noise. The same arrangement can be used on a six-cylinder engine.

Several of these engines were tested in an automobile and some tractors with satisfactory results. Valves, cylinder walls, pistons, and piston rings appeared to be better off than in a gasoline engine. All of the engines were built from standard production gasoline-engine cylinder blocks, pistons and bearings. The engines were started by 6-v starters or a hand crank, and primed with gasoline when cold. No warming up was required as the engines ran steady regardless of temperature.

Various fuels were used with surprisingly similar results. Knock rating, ignition rating, and volatility did not make much difference in performance. If this engine were more highly developed, however, it would probably perform best with fuels having a moderate octane rating. Performance curves are shown in Fig. 9.

## Thermodynamics of Vapor Power Plants for Motor Vehicles

By Edmund B. Neil,  
Consulting Engineer

A NEW approach to vapor power-plant design, utilizing principles of automotive construction, is essential to their serious consideration for motor vehicle use. With a few known exceptions, virtually all engines have followed classical design to date, being of double-acting two-cylinder, piston-rod type (a few of three cylinders) using one or another type of link-motion, with cranks at 90 deg so that best balance is impossible. Engine speed is

limited by the inertia of the link system and rod assembly as well as lack of inherent balance. Consequently engine speed has been limited to about 1000 rpm or slightly higher.

Since the same factors relative to power output per lb of weight and per cu in. of displacement apply to a vapor engine as well to an internal combustion engine, it is logical to suggest that vapor engine speed be materially increased. Due to the two-stroke cycle effect in a vapor engine cylinder, four cylinders equal the impulses of a four-stroke eight-cylinder engine. Speeds need not be as high as is customary with many Otto cycle engines produced today, but they could be double those of previous type and still be about one-half the rpm of some current internal combustion engines. Or if the same speeds were used, nearly twice the power per cu in. of displacement can be obtained. However, the valves operate at twice usual four-stroke speed, so they may introduce the usual problems incurred when engine speeds are raised above about 4000 rpm. Speeds, approximating 2000 rpm should impose no new problems if automotive design is used. Trunk-type pistons and connecting rods, cam-actuated poppet valves, pressure lubrication and other distinctly automotive practices could be employed.

Theoretical expansion ratios may range up to approximately 40 to 1 when steam from about 1000 psi is expanded to atmospheric pressure. Since the end pressure must be higher than atmospheric with engine speeds approaching one-half those in internal combustion engines, the effective expansion ratio becomes smaller. An unavoidable heat loss is thus introduced, just as with internal combustion engines. However, it is reasonable to expect that the effective expansion ratio can be equal to or higher than in Diesel engines. Compounding may therefore be necessary to obtain highest possible efficiency.

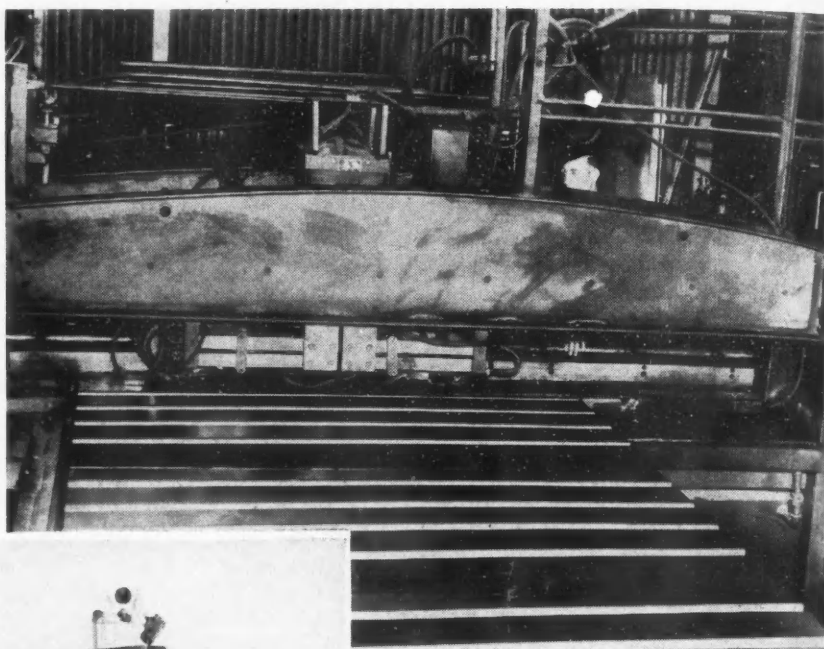
From information obtained to date the top limit of expansion which can be obtained in a single cylinder of a vapor engine has never been determined. The mechanical or clearance volume-displacement ratio can be increased above Diesel ratios by design, but another factor is involved. This concerns the rate of heat convection from cylinder head to skirt or lower end. With a steam temperature of 750 F, the difference between head and skirt temperature may not be sufficient to permit as full expansion as desired. The problems are analogous to those involved in the air-cooling of aircraft engine cylinder except that in the vapor engine it is the skirt of the cylinder rather than the head that may require cooling. Even with slow-speed steam engines such controversial questions as the effects of initial cylinder condensation, cylinder wall area, bore-stroke ratio, cylinder size, have apparently never been answered satisfactorily to investigators.



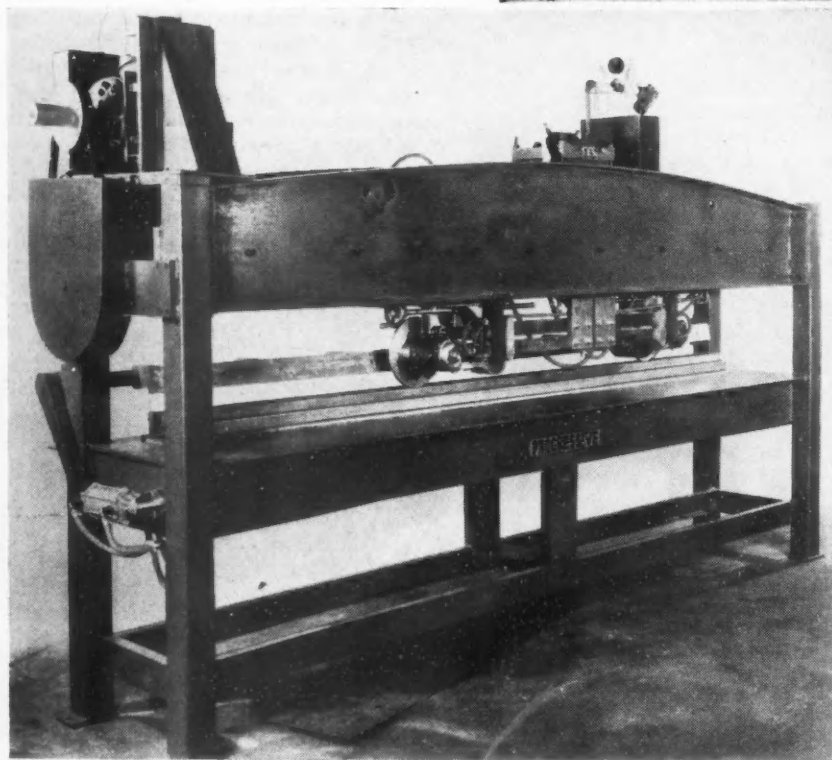
# Welding Time Cut in Half on Trailer Body Panels

**W**EATHERTIGHT joints between the alloy or stainless steel panels that form the sides and top of highway trailers are obtained at the plant of the Fruehauf-Carter Div., Fruehauf Trailer Co., Memphis, Tenn., in half the usual time by using a dual 100 kva seam welder designed and produced by Progressive Welder Co., Detroit.

Time for welding the lapped seams on the 18 gage trailer panels is cut in half by equipping the machine with two traveling welding wheels, which weld simultaneously. Each wheel welds half the entire seam. Both welding wheels are adjustable as to relative position by means of hand wheels, so that any width stock, up to nine ft wide, can be lap welded in this man-



*(Above) Double seam welder in operation at plant of Fruehauf-Carter Div., Fruehauf Trailer Co.*



*(Left) Dual 100 kva seam welder designed and produced by Progressive Welder Co.*

ner. One welding wheel always finishes up where the other started.

To provide ample clearance for mounting the panels in the machine, the welding wheels have a maximum vertical travel of three in. Pneumatic clamping holds the panels firmly in place. Speed of the welding wheel carriage is accurately adjustable through a variable drive which provides a range of welding speeds of from four to 12 fpm (eight to 24 ft of total seam weld per minute). Welding pressure is provided by a pneumatic cylinder actuating a full length clamping bar.

## Electroplating Process Aids Welding of Aluminum to Steel

Developed by the National Advisory Committee for Aeronautics Welding Laboratory, Rensselaer Polytechnic Institute, is a method for welding sheet aluminum to SAE 4140 steel which is said to provide a good bond both from the viewpoint of strength and thermal conductivity. The process, which was developed to weld half-hard 3S aluminum fins to the steel cylinders of an

aircraft engine, involves the electroplating of the steel with a layer of silver of proper thickness. The welding equipment is then used to make a proper bond between the electrode and the aluminum. In order to effect this bond, a heat balance was secured by means of a high-resistance insert between the electrode and the aluminum. Thus, the bond is made at a tempera-

ture sufficiently low to avoid damage to the heat-treated steel. The National Advisory Committee states this recently developed method of joining aluminum to steel should be of importance to the solution of any problem involving the welding of aluminum to steel where strength is the primary consideration, whether or not thermal conductivity is important.



# NEW Production and Plant EQUIPMENT

## B-49—Induction Heating Machine

The TOCCO Division of The Ohio Crankshaft Co., Cleveland, Ohio, has made a new addition to its line of induction heating machines. The newest is a 750 watt 450,000 cycle TOCCOtron—a bench type machine designed primarily for silver brazing and soldering, but also adaptable to hardening, annealing and forging applications within its power capacity.

The new low-cost unit is of the tube oscillator type. It operates from a 110/120 volt a-c single phase 60 cycle current source and is tapped to accommodate either single or multiple-turn inductor coils. An outstanding feature is the fact that the new unit requires no water connections.

This small TOCCOtron unit is suitable for both automatic or manual operation.



750 watt TOCCOtron brazing bel-lows assemblies

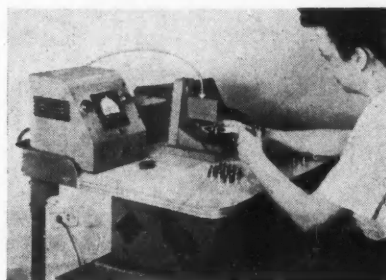
eration. It is designed to operate continually at full load for mass production work yet is readily adaptable to quick set-up changes required by job-shop or tool room operations. Inductor coils can readily be made by simply forming copper tubing or wire to the required shape.

## B-50—Electronic Segregator

The DoALL Co., Des Plaines, Ill., has brought out a new device for 100 per cent inspection of small parts. Known as the Model DS-20 Selector, it is an electronic segregator for the automatic sorting of small parts into three classifications, oversize, acceptable and undersize. Said to be accurate to .000010 in., the Selector will sort parts with tolerances from + or -

.0001 in. to + or - .005 in. at speeds up to 12,000 parts per hour.

The Selector consists basically of three units, the gage head, the master control, and the segregator. The head, where the actual measurement is done, is so designed and constructed as to



DoALL Selector

have no frictional moving parts, no coils, no switches and no magnets to need adjustment. Because of the unique electrical circuit the speed of operation is limited only by the rate at which parts can be fed into the Selector. Fully automatic and semi-automatic feed mechanisms are available. Besides having red and green indicating lights, the master control unit has on it a graduated indicating dial gage providing visible readings of the size of each part as it is being sorted. This gage is electronically operated and hermetically sealed against dust and moisture.

The Model DS-20 comes as a "packaged unit" ready for operation. Besides the gage head, master control, and segregator, the gage head stand, the table, chair and three tote pans are furnished.

Clark "Yardlift-40" fork lift truck



## B-51—Pneumatic-Tired Fork Lift Truck

"Yardlift-40" is the name of a newly developed pneumatic-tired fork lift truck introduced by Clark Tractor, Battle Creek, Mich. Designed for working outdoors and on surfaces too uneven for solid tired machines, "Yardlift-40" has a capacity of 4000 lb at 24 in.; has a lift of 120 in. with 85½ in. overall height; and with few exceptions, standard Clark Carloader forks and attachments can be used.

A pivoted steering axle mounting and three-point suspension of the truck make for smooth operation over uneven surfaces. A new type of drive axle permits a 42-in. overall width and a high degree of maneuverability. A heavy duty transmission provides speed of 9.4 mph in high and 2.9 mph in low, both forward and reverse.

Accessibility for effective service has been increased, with an engine compartment arranged for easiest access; including 32 by 11 in. side louvers and divided hood, for easy removal. A universal joint between transmission and drive axle permits easy clutch removal.

Tire change is simple by removal of demountable rim secured by four lug-bolts; and ample clearance has been provided for tire chains on the drive wheels, to facilitate all-weather operation. Minimum under clearance with the truck empty is 5¼ in. under the center of the drive axle.

## B-52—Automatic Metal-Cutting Saw

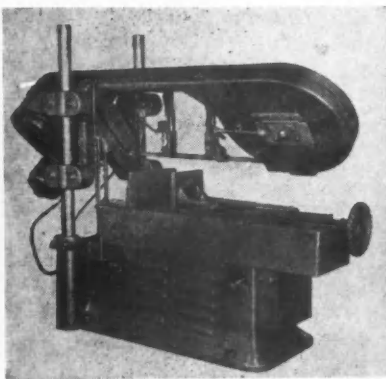
The Wells No. 12, a new heavy-duty, horizontal, metal-cutting band saw, features an automatic cutting cycle in which the blade is fed into the work at a constant pressure and the cutting head is returned by hydraulic power to its starting position above the work upon completion of the cut.

The saw, developed by Wells Manufacturing Corp., Three Rivers, Mich., is designed for cutting off rectangular stock up to 12 in. deep by 16 in. wide or cylindrical stock up to 12¾ in.

# NEW Production and Plant EQUIPMENT

diameter. In addition to cutting through stock, the saw can be automatically controlled to cut to any desired depth for work on dies or other parts.

The saw is of heavy, rigid construc-

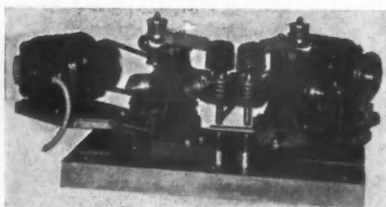


*Wells No. 12 metal-cutting band saw.*

tion. The base and bed are castings. The cutting head rides on closely fitted rollers on two heavy columns. The hydraulic system is enclosed in the base. The saw blade is enclosed except at the cutting zone. Vise is quick-acting type.

Cutting speeds are 50, 90, or 150 fpm. A  $\frac{3}{4}$ -hp motor drives the blade and a  $\frac{1}{2}$ -hp motor drives the hydraulic pump. Overall dimensions are: 59 in. high by 78 in. long by 32 in. wide. Shipping weight is approximately 1750 lb.

## B-53—Twin Head Riveting Hammer



*This Model 2AHD bench-type, high-speed hammer, made by the High Speed Hammer Co., Inc., 313 Norton St., Rochester 5, N. Y., has a capacity of  $\frac{1}{8}$  in. to 5/32 in. rivets. Its twin heads form two rivet heads simultaneously with a minimum center line distance of 2 $\frac{3}{4}$  in. to maximum distance of 12 in. The clutch mechanisms are hydraulically operated.*

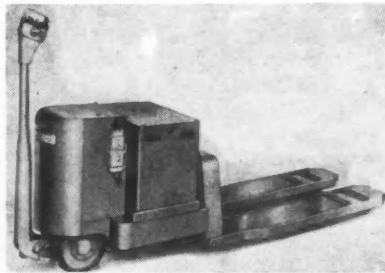
## B-54—Hydroelectric Motorized Lift Truck

The Model "K" hydroelectric motorized lift truck is announced by Lift Trucks, Inc., 2425 Spring Grove Ave., Cincinnati 14, Ohio. This new model is being produced in pallet and platform styles in a variety of sizes, all having a 4000 lb capacity with two forward speeds and two reverse, plus dynamic braking.

Features include the Stuebing two-wheel front drive and an improved dynamic brake controlled by a push button.

Designed for complete electrical operation, a motor and pump comprise the power lift. Known as the "Stuebing Power Package," motor and control are designed especially for industrial truck service. The entire unit—motor, drive and controller—can be removed from the frame like an outboard motor.

All speeds and the brake are instantly controlled by three push but-



*Model K lift truck*

tons contained in the steering handle. Forward and reverse buttons are two-position, giving low speed when partially depressed and full speed when depressed to the second position. All buttons operate at all times, regardless of the position of the handle.

## B-55—Industrial Lubricating Unit

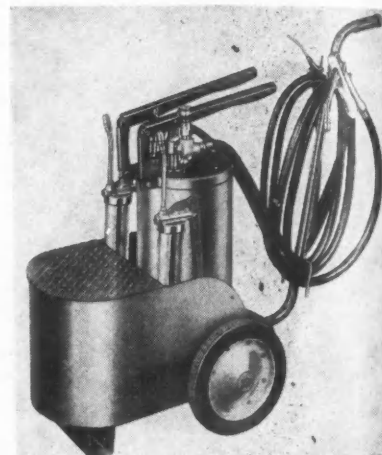
A new industrial lubricating unit for plant-wide use is now being delivered by the Industrial Division of Gray Co., Inc., Graco Square, Minneapolis 13, Minn.

The Graco lube service cart is a complete lubrication department on wheels, which needs no air or electric connections. It carries a generous supply of three different lubricants (two greases and one oil).

This specially designed, one-man op-

erated, portable unit is mounted on two semi-pneumatic tires. Maneuvering easily between closely placed machines, the lube service cart is said to speed up production schedules by reducing lubrication time.

Two one-lb lever guns and one  $\frac{1}{2}$  pt pistol oiler are included. Pressure lube



*Graco lube service cart*

pump has built-in gun loader for hand guns. Lube and oil compartments are easily filled without removing pumps. The front section of the cart incorporates a large tool box, with hinged lid, which also serves as a platform step for the operator to reach high bearings.

## B-56—Heavy-Duty Vacuum Cleaners

A line of six heavy-duty vacuum cleaners for industrial and commercial use, a complete set of industrial vacuum cleaning tools and two heavy-duty blowers are now being shipped in quantity by the General Electric Company's vacuum cleaner division.

Although each cleaner is designed for a specific type of industrial or commercial cleaning, the six models are basically similar in design and use. All are high-powered machines, incorporating universal type ac/dc air-cooled motors. Maximum filtering area is provided to assure greatest cleaning efficiency. Weight of the portable machines is held to a minimum.

Two of the models are designed for wet pick-up. The powerful suction pulls water out of cracks in wood floors and dries the floors almost immediately—thus eliminating the necessity for dry mopping. Both models are also used effectively in squeegeeing rugs and upholstery.

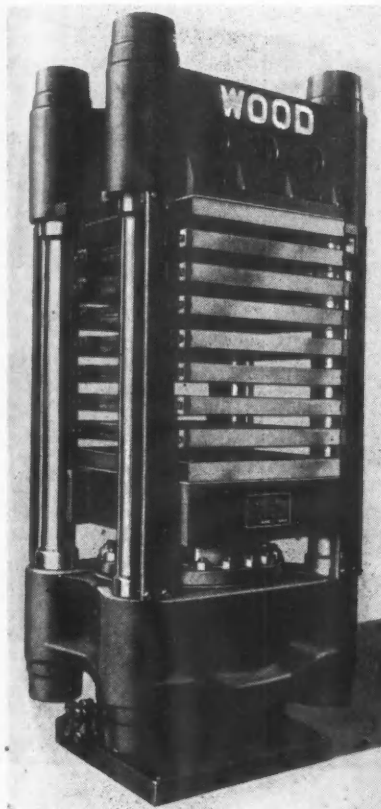
Top model in the line is the 184-AWP, designed for wet or dry pick-up. This one-hp unit has a 1 $\frac{1}{2}$ -bushel capacity, a 60-in. vacuum, 1220 sq in. of filtering area. It weighs 87 lb. A special safety-fuse prevents over-filling of the container with liquids and possible

damage to the air-cooled motor.

The other wet-or-dry cleaner, Model 175-A, weighs only 50 lb, and is designed primarily for use in office buildings and commercial establishments. It has a 46-in. vacuum, a 17 by 17-in. container.

Largest of the cleaners designed for dry use only is the 184-A, which may be used in everything from buses and offices to foundries. A one-hp unit, it has a 1½ bushel capacity, a 55-in. vacuum, 1220 sq in. of filtering area. It weighs 78 lb.

Other cleaners are the Model 203, a 30-lb machine; the Model 169-A, which weighs 47 lb; and the Model 175, designed for furnace and boiler cleaning.



### B-57—Wood Platen Press

This 870-ton multiple opening platen press of four-column type was designed by R. D. Wood Co., Public Ledger Bldg., Philadelphia, Pa., for processing rubber, and plastic sheets. Its cylinder unit is cast integrally with a substantial square base supporting the press on the foundation. Both the top and moving platens are made of heavily-ribbed cast steel of box-section design. The heating platens are made from special-process, rolled, firebox steel, smooth-tool finished and parallel to within .003 in. Asbestos insulation minimizes heat dissipation into heavy castings, being provided between the top and the moving platens and the adjacent heating platens. This press model can be equipped with push-back cylinders mounted in the top platen. Various sizes and capacities of this multiple-opening press can be furnished to meet production requirements.

## New Production and Plant

# EQUIPMENT

### B-58—Electric Brake and Clutch

The Warner Electric Brake Mfg. Co., Beloit, Wis., has, since 1927, manufactured a line of electric brakes for automotive trailer use. Thousands of these brakes have been installed and operated under widely varying types of application and severity of service. From the experience and manufacturing know-how, gained in this field of application, comes the "ICB" line of brakes and clutches for industrial use.

The Warner electric brake and clutch consists of a simple electromagnet and an armature disc. The armature, when used as a brake, rotates with the shaft or pulley, while the magnet remains stationary. When the magnet is energized, it attracts the armature and creates the braking or clutching effect through friction of the magnet poles and the magnet face lining material, upon the armature. As a clutch both the magnet and armature rotate with whatever part, hub or pulley to which it is attached. The magnet receives its current through collector rings and brushes.

An annular coil is firmly impregnated and embedded directly below the friction facing. This friction surface is of a selected grade of molded friction material. When the coil is energized the magnetic pull attracts the armature, which is normally held in light contact with the magnet by light spring

pressure. When the coil is de-energized the magnetic pull and resulting friction ceases. The bronze filled air gap is provided to insure that the residual magnetism is held to a minimum.

The wear surface of the armature is

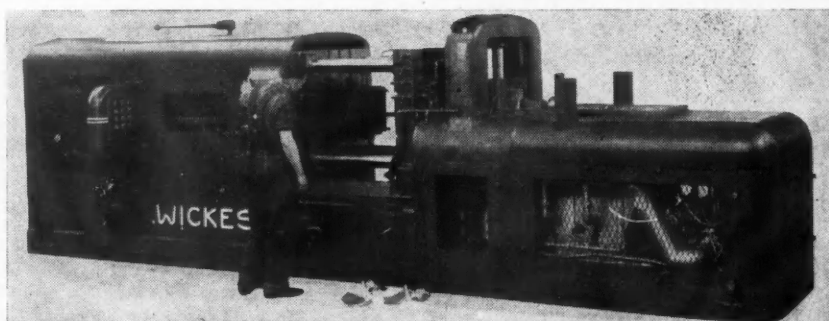


Two principal parts of Warner "ICB Unit", the ring-shaped electro-magnet and the segmental armature disk.

made up of a number of segments of magnetic material. Because of this segmental construction expansion due to heating is largely linear and the armature remains in full contact with the magnet. The armature backing plate is fluted so that it acts as a blower and

(Turn to page 90, please)

### B-59—Automatic Die Casting Machine



This Wickes No. 4 die casting machine for zinc, tin, and lead has just been developed by Wickes Brothers, Saginaw, Mich. The machine will produce castings automatically by pushing an electrical start button. Provision has also been made for manual operation of any single function of the die casting cycle. High production of this machine is gained by the rapid closing and opening of the dies at 750 ipm with a momentary slow down just before the dies close. The casting knockout is automatic and hydraulically operated, or can be manually operated if desired. Injection pressure is supplied by heavy duty accumulator which supplies the quick hammer blow pressure to twin injection cylinders.

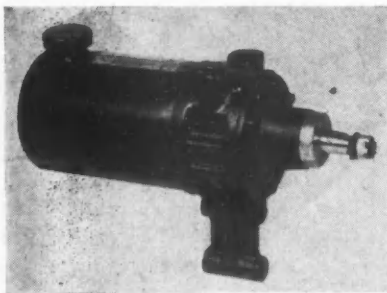


# NEW Products

## C-74—Auxiliary Vacuum Pump

A new auxiliary vacuum pump which combines a pump, an oil separating tank and reservoir in one compact unit weighing only 8½ lb. has been developed by the Bendix Products Division, Bendix Aviation Corp., South Bend, Ind.

This pump is designed for use on gasoline engine-driven trucks and tractors where it is said to maintain a high degree of vacuum even when the vehicle



*Bendix auxiliary vacuum pump*

is operated for long periods with wide open throttle.

The construction and principles of operation are similar to the larger Bendix Convac pump for Diesel truck operation.

The body of the pump provides a closed cylindrical chamber. Inside this cylindrical chamber, a rotor turns on an axis of the cylinder. Three vanes are provided in the rotor, mounted so that they follow the surface of the cylinder bore.

These vanes divide the space between the rotor and the cylinder bore into three airtight compartments. As the rotor turns, the volume of each of these three compartments increases and decreases due to the eccentric position of the rotor.

An inlet port is provided so that air is drawn into each of the three compartments during the part of the turn where their volume is increasing; an outlet port is provided through which air is expelled as the compartments decrease in volume. The result is that a high vacuum is created on the inlet side of the pump.

The pump reservoir, holding one pint of engine oil, is provided with a series of baffle plates which separate the air from the oil after it has passed through and lubricated the pump. A dip stick gage is fastened to the reservoir filler

cap to enable a quick and easy check of the oil supply in the reservoir.

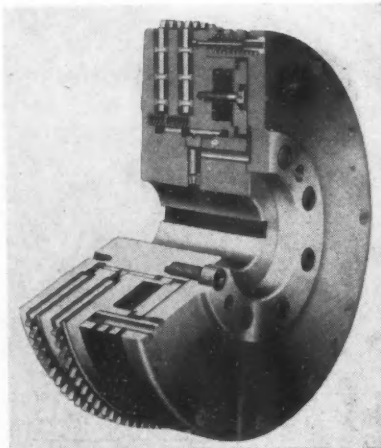
This being a self-contained unit, there are no oil lines leading to and from a separate reservoir. Because of its compactness, it is readily adapted to almost any installation.

The pump may be installed on and driven by the engine or by separate electric drive. Any standard ½-in. Vee belt may be used and the drive pulley can be located on the crank shaft, an extension on the generator shaft, or it can be an auxiliary pulley on the fan hub. The pump is designed to operate at 4000 rpm, at maximum rated engine speed.

## C-75—Air-Actuated Heavy Duty Clutch

A new air-actuated clutch, the Model PH, has been designed and is now being built by the Twin Disc Clutch Co. of Racine, Wis. This clutch is available in 30-in., 36-in. and 42-in. sizes.

The new Model PH clutch supplements the regular line of Twin Disc Model P air-actuated clutches and widens the range for selection of a unit to fit any need. Sizes of the two models of air-operated clutches now run from 14 to 42 in. with capacities from 75 hp to 1325 hp. Torque ratings range from 900 lb-ft to 89,550 lb-ft.



*Cut-away view of Model PH air-actuated clutch*

These new torque ratings have been obtained by modifying the basic Twin Disc air-operated clutch design to permit increased air cylinder areas, thus making the Model PH clutches espe-

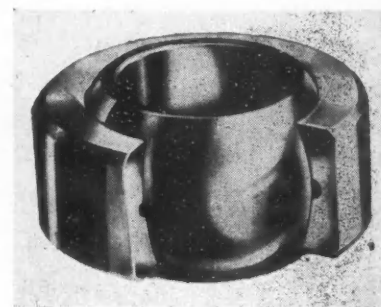
cially suitable for application in the petroleum industry and for heavy-duty construction equipment.

All Model PH clutches are equipped with heavier, new-type spline tooth construction on the clutch hub, center plates, and floating plates. To counteract heavy shock loads and to reduce gear tooth wear, Model PH-36 and PH-42 clutches also are built with a two-piece hub and back plate construction. The hub is made from a steel forging and the back plate from special alloyed cast iron.

The Air-actuated clutches operate by remote control without a complicated linkage system, and shaft space is greatly reduced. Any desired amount of air pressure, within certain limits, can be applied to the friction plates to provide either slow or fast engagement. Complete and adequate lubrication is provided by oil entrained in the actuating air.

## C-76—Spherical Self-Aligning Bearing

Adel Precision Products Corp., of Burbank, Calif., announces the manufacture of the new HALFCO spherical self-aligning bearing. The unique de-



*HALFCO self-aligning bearing*

sign of this bearing makes it adaptable to a wide variety of applications; as a rod end bearing, rotation bearing, static and self-aligning bushing, etc.

The HALFCO bearing consists of only two pieces. The outer race is of hard bronze, which is integrally formed around a hardened, highly-polished, precision-ground steel ball. HALFCO bearings may be fabricated from a wide variety of metals, to meet specific installation requirements.

The HALFCO bearing allows the greatest possible misalignment, full spherical surface contact permits extremely heavy loading, and it resists both axial and radial thrusts.

## C-77—Locating Microscope

A locating microscope which reverts the image to upright and easily picks up edges, contours, irregular shapes, and holes too small for an edge finder or indicator, is offered by the Moore

# New PRODUCTS

Special Tool Co. Inc., of Bridgeport, Conn.

A roof prism in the Moore microscope enables the operator to see the work in the same position as without it. Table settings can be made without the confusion of transposing reversed or inverted table movements.

In addition to a double pair of cross lines, spaced .001 in. apart, the Moore reticle contains a large number of conveniently spaced concentric circles



Moore microscope

whose lines are broken to facilitate locating small holes or large radii otherwise covered by the line.

Magnification of 40X, enough to see a "tenth," is said to be achieved without unduly reducing the field of vision or making adjustments too critical. The Moore microscope provides a field of vision wide enough to include a full 1/4 in., simplifying the picking up of a reference point.

Designed for use in the Moore jig borer or Moore jig grinder, the microscope extends the usefulness of either machine by converting it into an inspection machine for hole location, contour shapes, finish or surface conditions. Locational accuracy is quickly determined by substituting the microscope for the cutting tools or grinding heads, and work may be checked without disturbing the set-up in the machine.

With a suitable shank or adapter, the Moore locating microscope may be attached to any machine or inspection tool requiring an optical pick-up device.

## C-78—Carboly Offers Two New Products

Two new products have recently been placed on the market by Carboly Co., Inc., Detroit 32, Mich.

Solid Carboly cemented carbide balls for use in check valves and for sizing and burnishing—ground to tolerances of .0002 in. on the diameter—are now available from stock. The balls are standard only in Carboly Grade 44A, a carbide which combines

great toughness with good resistance to wear. The 10 standard sizes of the Carboly balls run from 1/8 in. to 1 in. in diameter.

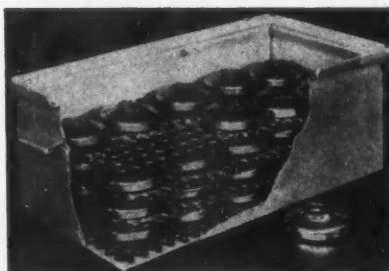
Lengths of solid Carboly cemented carbide rod—unground and in both random and specific lengths—also are available from stock. There are 15 standard stock diameters, ranging from 1/64 in. to 1/2 in., with stock allowance on the diameter of from .007 in.—.012 in. on the smallest size to .022 in.—.050 in. on the largest size. Random lengths furnished will vary from 4 in. to 12 in., but with sufficient extra stock to compensate for any rough ends.

## C-79—Electrode for Copper Welding

The Air Reduction Sales Co., 60 E. 42 St., New York, N. Y., has brought out a new welding rod, the Aircro No. 23A. This rod is of a silicon-copper analysis, while the previous rod offered for copper welding was of a phosphorus-deoxidized copper analysis. In addition to having superior flowing characteristics, this new silicon-copper welding rod is said to provide stronger welds than the deoxidized copper analysis and also provides an excellent color match on copper. According to the manufacturer, the new Aircro No. 23A welding rod is the equal of silver-copper rods for this class of work.

## C-80—Rubber Covered Separators

Woven wire screen and expanded or perforated metal in all meshes and sizes, completely covered with rubber,



Rubber covered mesh separators

are made available for material handling purposes by Automotive Rubber Co., Inc., 3659 Epworth Blvd., Detroit 4, Mich.

Purpose of the screens is primarily

to protect, by rubber cushion, parts which have been plated, painted or precision finished so they will not become scratched, marred or disfigured by contact with metal surfaces. The mesh separators likewise permit drainage.

Any size separators can be furnished to fit bottoms of tote pans, conveyor baskets or pallets and can be covered with hard, semi-hard or soft natural rubber or synthetic rubber to meet specific conditions encountered.

Such screens are said to have been used successfully in trials as separators in palletizing and stacking parts. In these applications, it has been found that rack tipping and skidding of the tiers is materially reduced.

## C-81—Electric Lubrigun

Model 244 Lincoln electric-motor operated Lubrigun is the newest addition to the line of lubricating equipment



Lincoln Lubrigun

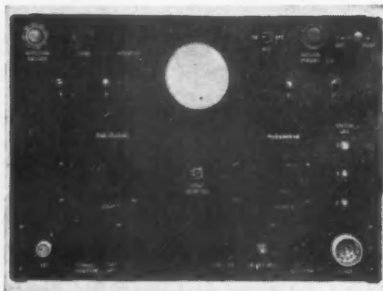
made by the Lincoln Engineering Co., 5701 Natural Bridge Ave., St. Louis 20, Mo. This high pressure grease gun is a streamlined, portable unit equipped with a positive displacement pump, powered by a standard make 1/4 hp universal motor for 110/115 volts a-c or d-c. It provides rapid, positive delivery of all types of lubricants which readily seek their own level. The unit is mounted on two large rubber tire casters and one ball-bearing swivel caster for maximum portability. Full lubricant pressure is instantly available.

# NEW Products for AIRCRAFT

## C-82—Semi-Automatic Navigation Aid

To provide overseas airlines with a semi-automatic navigational aid for bringing aircraft to their destinations from distances up to 1500 miles offshore, the Philco Corp., Philadelphia, Pa., has placed on the market a new 35-lb direct-reading Loran receiver that is said to give position "fixes" precisely in seconds instead of minutes, without chance of human error in taking the readings.

This new postwar navigational device, called the "Philco Seaguide," receives signals from Loran shore transmitters at ranges up to about 1400 nautical miles at night and approxi-



*Philco Seaguide*

mately 750 nautical miles during the day. An innovation over any previous Loran is reception on six frequency channels, four for the present high-frequency Loran shore stations, and two low-frequency channels for the new long range transmitters now being developed by the United States Government.

The entire "Seaguide" consists of a single unit measuring 15 in. by 15 in. by 10 in. All tubes are new miniature tubes, except the rectifier and cathode ray tube.

## C-83—Tandem-Type Fuel Pump

A new advance in the field of aviation safety is reflected in the development of a "dual pump" by the Pesco Products Division of Borg-Warner Corp. Described as a tandem-type high pressure fuel pump, it is used for turbojet engines and aircraft gas turbines.

Two important safety factors are embodied in the new device. First, if the main engine pump should fail, Pesco's standby pump can supply enough fuel to operate the engine at

full power. This is in contrast to the early types of jet-propelled aircraft which carried electric motor-driven standby pumps capable of operating the engines at only partial power output. Second, since the new tandem fuel pump is installed on the engine accessory drive gear box, the excessive weight penalty for electric motor and generator has been eliminated.

The tandem pump primarily consists of two of the standard Pesco gear type fuel pumps combined with the automatic changeover valves, all enclosed in one housing.

## C-84—Stainless Steel Battery Box

A new stainless steel Lifetime battery box for use in airplanes is announced by McDowell Manufacturing Co., Pittsburgh 9, Pa.

The corrosion resistant stainless steel interior of the McDowell battery box is said to enable it to outlast boxes made with ordinary materials and to eliminate the necessity of applying protective coatings of acid-proof paint.

The lid fasteners with which the new box is equipped require no tools for release and permit speedy access to the battery for servicing.

The McDowell Lifetime Airplane Battery Box is available in sizes No. 1, No. 3, and No. 5.

## C-85—Insulated Antenna Wire

An insulated aircraft antenna wire which, according to the manufacturer, largely overcomes the undesirable effects of precipitation static in aircraft communication has been developed by Federal Telephone and Radio Corp., Clifton, N. J.

This Federal wire, designated Intelin Type K-1064, when used with proper antenna hardware, is said to be a simple yet practical means of reducing one of the major hazards encountered by pilots flying in bad weather. The result of corona discharges of static potentials accumulated on planes flying through rain, snow or dust, or near charged clouds, precipitation static often entirely drowns out transmission and reception at a time when the pilot is in most need of his radio. The airplane's exposed antenna is usually one of the chief points of discharge of

these static charges and Federal's new wire gains its effectiveness by shielding the actual conductor with a jacket of polyethylene insulation.

The "Copperweld" conductor used in this wire provides the high tensile strength required for exposed aircraft installation, while its polyethylene insulation assures durable, weather resistant service. The conductor, No. 16 AWG H.S. "Copperweld" (30 per cent conductivity), has a nominal outside diameter of 0.0508 in., while the polyethylene semi-transparent insulation has a nominal outside diameter of 0.183 in. The wire has a tensile strength of 127,000 psi minimum.

## C-86—Actuator for Trim Tab Control

Airborne Accessories Corp., 25 Montgomery St., Hillside 5, N. J., is introducing a new type of motorized actuator for aircraft trim tab control.

Known as "Trim-Trol," it is intended for operation on 26-volt d-c power. The unit employs a novel principle of varying mechanical advantage increasing with tab load, which permits one basic design to handle an extremely wide range of applications.

Incorporating motor, magnetic brake, gear reduction, limit switches, and



*"Trim-Trol" actuator*

electrical position transmitter in one package, it is arranged for mounting in the leading edge of the control surface and can be directly connected to the tab with a simple self-aligning link. No screw jacks, flexible shafts, angle drives, or other devices are required to complete the installation.

## C-87—Alternating Current For Aircraft

The practical application of alternating current electric plants for aircraft has been disclosed by the Westinghouse Electric Corp. These a-c generators provide 50 per cent more power per lb of weight than comparable direct current generators.

The newly developed equipment has been installed on two giant bombers:

(Turn to page 68, please)





# FIVE Advantages of Inland HI-STEEL

*The low alloy, high strength steel*

## 1 HIGHER STRENGTH

In contrast with ordinary structural steel, Inland Hi-Steel has nearly twice the yield strength, the same elongation, and almost 50% higher fatigue strength. With Hi-Steel, designers can increase strength without resorting to excessive weight and size of parts. On mobile units, Hi-Steel increases payload without sacrificing strength.

## 2 GREATER CORROSION RESISTANCE

Hi-Steel has more than twice the atmospheric corrosion resistance of copper-bearing steel and about five times that of ordinary structural steel. When its bare surface is exposed for a long period, the elements in it contribute to the production of a dense adherent rust which acts as a protective coating and greatly retards further corrosion.

## 3 MORE RESISTANT TO ABRASION

In resistance to abrasion, Hi-Steel is far superior to copper-bearing and ordinary structural steels. Coal companies and other bulk material producers use Hi-Steel in chutes, screens, and bunkers because of its long life. Where both abrasion and atmospheric corrosion are combined, Hi-Steel will outlast many "abrasion-resistant" steels.

## 4 EASY TO WORK

Because of its high ductility, Hi-Steel can be worked either hot or cold with little or no deviation from standard shop practice. It does not normally require heat treatment to retain or to restore its normal properties after working. Hi-Steel can also be flame cut as easily as ordinary structural steel, and can be welded by conventional methods.

## 5 LOW IN COST

The price per pound of Inland Hi-Steel is only moderately higher than ordinary structural steel. However, where a given strength is desired, sections of Hi-Steel can be made lighter, so the total cost of steel is frequently not increased. On mobile equipment, this weight saving quickly pays for the small difference in price by an increase in payload.

**HI-STEEL meets the requirements  
of SAE Specification 950**

*Hi-Steel is rolled in structural sections, bars, plates, strip, and sheets. While the supply is limited, every effort is being made to bring you Hi-Steel in greater quantities.*

**Write for Booklet**

# INLAND STEEL

**INLAND STEEL COMPANY**

38 South Dearborn Street, Chicago 3, Illinois

Sales Offices: Detroit, Indianapolis, Kansas City, Milwaukee, New York, St. Louis, St. Paul

# Processing Torsion Bars with Special Equipment

**I**N KEEPING with the general interest in torsion bar suspension, the following description of the methods employed in making torsion bars for the Fruehauf Trailer Co. Gravity Tandem Suspension (described Jan. 15, 1946, in *AUTOMOTIVE AND AVIATION INDUSTRIES*) should be quite timely. Fabrication begins when the centerless ground and inspected chrome-manganese steel bars are loaded onto the A-shaped bar conveyor of the high speed gas fired upset furnace designed by Mather Spring Co. and built by Newcomb-Detroit, Fig. 1, in which one end is heated to forging temperature and the bar then delivered to the upsetter. Following this the bar returns

to the furnace for heating the opposite end for the same upsetting operation. For this step the finished end is locked in a special fixture to make certain that the flat surfaces on both ends are exactly in line.

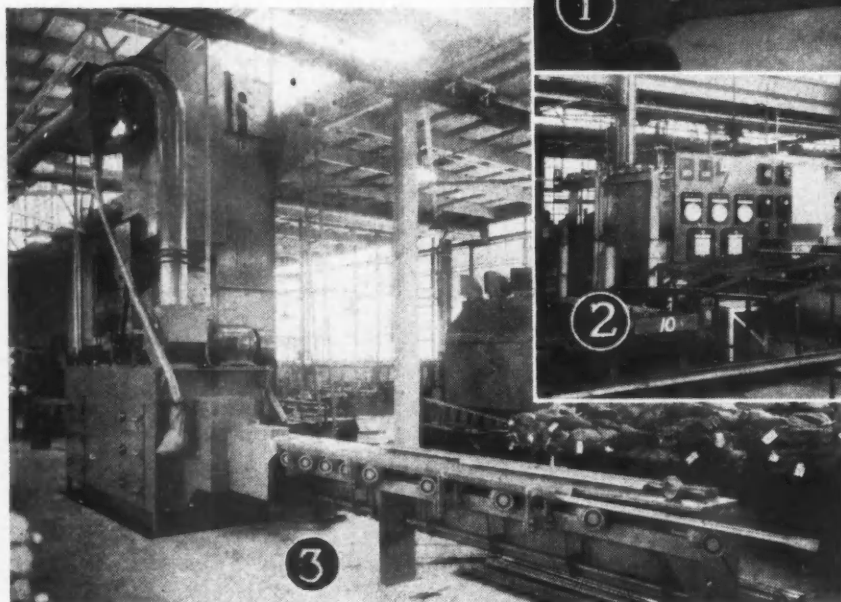
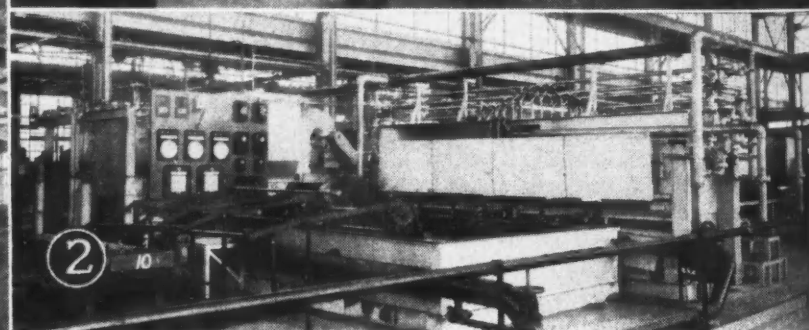
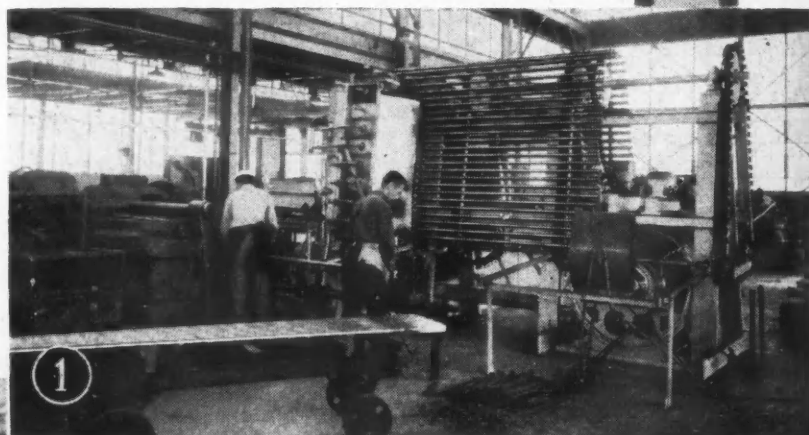
After forging the bars go to the high speed gas fired hardening furnace designed by Mather and built by Selas Corp., Fig. 2, for hardening at 1380-1420 F. Work is then quenched in oil and normalized in another furnace built by Newcomb-Detroit. Finally they

*(Turn to page 67, please)*

*Fig. 1—Centerless ground bars travel on the A-shaped conveyor, permitting one end to be heated to forging temperature in the furnace at the left. Following this the bars go to the upsetter at the extreme left.*

*Fig. 2—After both ends have been upset the bars are given the specified heat treatment—hardening in the furnace in the foreground, quenching in oil, and finally normalizing in the furnace shown here.*

*Fig. 3—Shot peening of torsion bars is handled automatically in this American Wheelabrator unit. Work is carried through the machine on the conveyor in the foreground which is fitted with revolving "hour-glass" shaped rubber spindles to assure uniform surface treatment.*

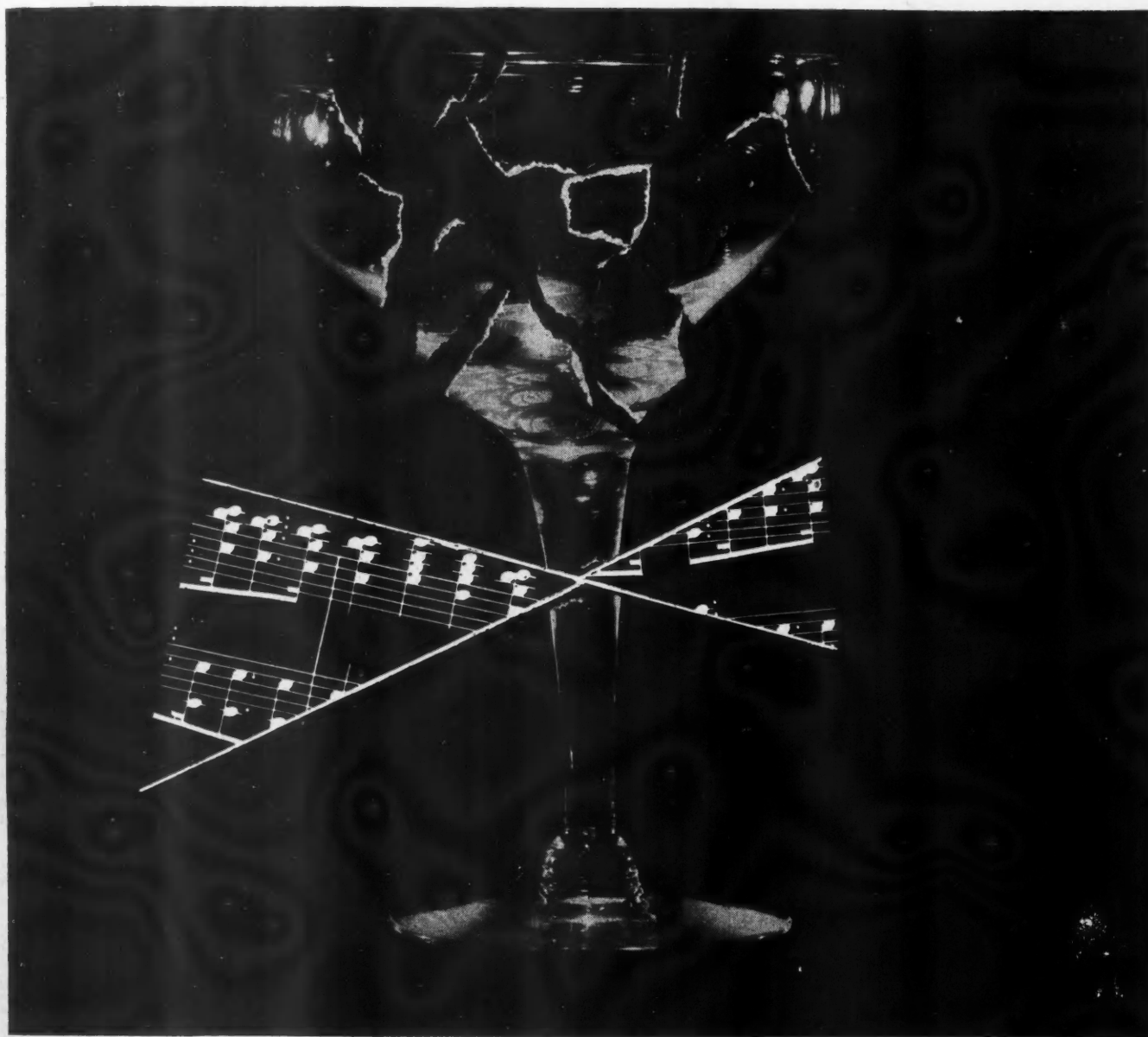


## A FEW NOTES TO REMEMBER

It is possible to shatter a wine glass with a sustained musical note because the glass is too brittle to distribute the peak stresses that are set up by resonance.

For the same reason, failure can result in a brittle steel, with far more serious consequences than a mere broken glass.

One way to increase safety factor and to obtain many other advantages, is to specify temper-brittle-free molybdenum steels. These modern steels, which also provide good hardenability, good strength-weight ratio, and economy, are permitting many users to simplify—and save. Write for practical data.



MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"  
CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

**Climax Molybdenum Company**  
**500 Madison Avenue • New York City**



# Observations

by Joseph Geschelin

## Machine Tool Progress

**P**RELIMINARY check of machine tool manufacturers indicates a tremendous variety of equipment of advanced type to be shown in Chicago in September. Transfer type machinery is the coming thing with many manufacturers participating. Although Buick is the first to have announced transfer lines for machining cylinder blocks and heads, others will have advanced transfer lines by the end of this year and early in 1948. Just the other day we were shown an outstanding transfer line—a relatively short one—for machining transmission cases. Also of interest is a confidential note that one of the prominent machine tool builders has developed a new type of crankshaft turn-milling machine designed to mill one or more crankpins automatically. This development will expand the number of companies now producing crankshaft equipment.

## Retainer Rings

**A**LTHOUGH the well known "truarc" retainer rings have been used widely, it is interesting to learn that Tucker intends to use retainer rings extensively in the design of the new car. Initial work shows that the details of the parts have been greatly simplified by the elimination of provisions for conventional threaded fastenings. In some instances the retainers provide thrust surfaces for bearing elements. This is an experiment worth watching.

## Quality Control

**T**o your editor in particular the current trend to statistical control of quality is of more than passing interest. Although the trend has not been industry wide, a number of leading manufacturers have installed control chart technique and have found it good. While the fathers of statistical control were struggling for industry recognition this publication gave them support. You will find extensive treatment of the fundamentals of the subject as well as de-

scriptions of statistical sampling methods employed in Western Electric plants, in this publication as far back as 15 years ago. We were just about 10 years ahead of the game. Actually the impetus to quality control came during the war when Army Ordnance issued its instruction manuals, later translated into war emergency standards by the ASA. A recent issue of its house organ describes the quality control system now in use in the plants of the Timken-Detroit Axle Co.

## Flying Automobiles

**O**NE of the major problems involved in the design of the flying automobile is the question of power plant. In order to provide sufficient power for a 3500-lb craft (gross wgt including detachable wings and tail surfaces), it is generally agreed that a 250 hp engine is required. This engine would serve the combination airplane-auto for both flying power and vehicle power, operating at about 175 hp in the air and about 60 hp on the ground. The big problem involved is how this engine can be operated smoothly at low automobile cruising powers. Valve timing would have to be altered; the manifold system would have to be designed for proper distribution at both 250 hp and 2 hp; and some method devised for circumventing the low mechanical efficiency of low hp operation. The valve timing problem could be solved, as has been suggested, by a cam shaft with two sets of cams which could be shifted longitudinally from one set to the other. Or possibly, variable lift and timing could be obtained by hydraulic-operated valve tappets and a single cam shaft. The distribution problem presents more difficulties, however; but if a satisfactory fuel-injection for an automobile engine were developed, this might be used in conjunction with a carburetor or fuel-injection system for flight use. Another means of obtaining satisfactory engine performance at low power outputs consists of designing a multi-cylinder engine in which some of the cylinders are cut out for part-load operation. These cylinders could be cut out by use of two crankshafts and gearing, by lifting the valves on the desired cylinders, or by a controlling device on the fuel-injection system if direct injection were used.

## White Shirt Foundry

**F**AIRBANKS, MORSE & Co. recently exhibited its new foundry serving the Freeport (Ill.) Works. Melting cast iron scrap in a Lectromelt electric furnace they have a capacity of 20 tons per day. Skillful attention to plant layout, and the use of equipment of most modern type coupled with extensive mechanization have combined to make a foundry of exceptional merit. It is clean and well ventilated, free from fumes and dirt. Unquestionably it has working conditions comparable to a good machine shop and will attract the same caliber of worker.

## Gadgetry Runs Wild

**J**UST one man's observations on the gadgets now festooning the new cars. Back-up lights, rear vision mirrors all around, fog lamps, clocks, special visors, and a host of other items are more or less familiar. But this year has seen the emergence of a large external windshield visor attached over the w-s header. It may be an article of utility but it certainly changes front end appearance. Many owners, either at the urging of the dealer or on their own volition, will not take delivery of a new car without seat covers. To us this means that the great amount of time and effort and money spent by motor car stylists in tailoring the interior is quite wasted. The stylist selects color combinations and orders upholstery of special color and pattern and cost only to have the ensemble completely disorganized by seat covers of chance pattern and color.

## Fuel Oil Carburetors

**S**EVEN or eight years ago we kept in touch diligently with two or three companies then experimenting with fuel oil vaporizing carburetors for gasoline engines designed to compete with Diesel engines for heavy-duty operations. Although they all fell by the wayside we found recently that one of the original group has revived interest in this development. The new device, however, is entirely different except for its trade name. It was redesigned during the war, now is arranged to burn gasoline while starting, idling and accelerating. It burns about 15 per cent gasoline, 85 per cent fuel oil, and fuel economy is more conservatively rated. Some of the units are said to have done well overseas. We hope to get you the complete story quite soon.

# JUST WHAT THE DOCTOR ORDERED....



## ... for All Assemblies!

**FORM-A-GASKET No. 1** (a paste) sets fast . . . but not too fast for use on large surfaces. It dries hard, but does not become brittle. It's a swell product for making pressure-tight, leak-proof unions . . . even if surfaces are warped.

**FORM-A-GASKET No. 2** (a paste) sets slower than No. 1. It dries to a tough, pliable layer with plenty of "cushion". It resists high pressures, continual vibrations and disassembles very easily.

**AVIATION FORM-A-GASKET No. 3** (a brushable, self-leveling liquid) sets into position and dries to a tacky paste. It will not run, even when heated to 400° F. nor become hard or brittle at temperatures down to 70° F. below!

**ALL TYPES OF FORM-A-GASKET PRESERVE ALL TYPES OF GASKETS!**

**PERMATEX COMPANY, INC., BROOKLYN 29, N. Y.**

# Airbriefs

by Robert McLarren

## Folding Tail

Bringing aircraft carrier folding wing experience to bear on the problem, Boeing Airplane Co. has designed a folding vertical tail surface on its huge B-50 bomber, successor to the fabulous B-29. Because the new, higher tail stands 38 ft high, presenting hangar problems, Boeing has mounted hinges in the main attachment fittings and designed a special mechanically operated jackscrew device which enables one man to crank the giant surface down laterally onto the horizontal surfaces. This reduces the height of the airplane to only 26 ft, well within the clearance of most large hangars.

## Water Troubles

One of the best examples recently of "hink ahead" engineering comes from Boeing Aircraft Co. The new Strato-cruiser will carry about 77 gallons of water for drinking, washing and use at the lower deck bar. Envisioning the world-wide use of the design on Pan American and foreign airlines, Boeing engineers recognized the possibility that the different mineral content of water around the world might easily corrode the plumbing of the giant airliner and so conducted extensive tests of different chemical fluids for the purpose. Final result is a water system using "Tenite 2" and polyvinyl chloride connections. The plastic has proved impervious to the minerals tested and, in addition, harmless to the water, following extensive "taste tests."

## Airborne Radar

Few debates have raged so vociferously and in such high places as has the subject of airborne radar, its pros and its cons. Quietly through the center of the controversy has come the fabulous Howard Hughes with a new, original design that has already been installed on TWA airliners. Dispensing with the cumbersome spinner and modulator units, the oscilloscope and the long interpretation training, Hughes new warning device is a simple danger signal, which flashes a brilliant light

when an airplane approaches within 2000 ft. of an obstacle ahead or 500 ft from below. Mounted in the nose of a Constellation, the device transmits 400 pulses per second out in the forward hemisphere which, when striking an object, are reflected back to a receiver. So sensitive is the device, that it emits warning pulses when flying over water at 2000 ft. as waves pass below! A demonstration of the device proved that 2000 ft. is adequate warning for a pilot to avoid the obstacle when Hughes flew a giant Constellation into a box canyon in the Southern California hills. He deliberately (and to the anxiety of his passengers) ignored the warning for a few seconds and then pulled up and out, clearing the cliffs by a number of feet. Hughes has ordered installation of the device on all TWA aircraft and will offer it at cost (\$135) to all other airlines in the nation. The Hughes Terrain Clearance Indicator weighs only 16 lb and was developed by David H. Evans, chief of the Electronics Division, Hughes Aircraft Co. Hughes readily points out that his device is not an elaborately complete radar installation for airliners but that it is here now ready for immediate use.

## Inter-Company Standards

The National Aircraft Standards Committee, an activity of the Aircraft Industries Association, has launched a plan for the publication of a company standards catalog containing standard parts other than Army-Navy and professional groups. This would make possible savings in the event a company desired standard parts that are neither A-N or company standard. When six different companies adopt a standard part, the Committee then plans to designate that part an "industry standard" with resulting savings through a single source of supply for all interested parties.

## Anglo-American Jets

In one of the surprise moves in aircraft engine industry history, Pratt &

Whitney Division of United Aircraft Corp. has completed negotiations for the manufacture of British Rolls-Royce turbojet engines in this country. The deal came about through the medium of Taylor Turbines, Inc., which acquired U. S. manufacturing and sales rights to the engines a year ago. Taylor, former Wright Aeronautical executive, originally asked \$1 million for his license, but he is understood to have settled for one-quarter that amount. P&W will manufacture the powerful Rolls-Royce Nene for use in the new Grumman XF9F Navy fighter plane. Both the Army and Navy have had Derwents and Nenes under bench tests for many months. In the meantime, P&W will continue development work on its own gas turbine engines. British publicists, prone to hail this as final U. S. admission of British leadership in the jet field, were modulated by John Wilmot, Minister of Supply, who told the House of Commons: "Gas turbines cannot come into operation until 1950-60 and to attempt to force them into operation would be to destroy their chance of success." He referred to commercial airline use, which the British have hailed as being readied for late fall or early spring.

## Industry Storm Warnings

The full picture of the current aircraft manufacturing industry in all its blackness has been presented to the Congress by the company presidents themselves. Layoffs, contract cancellations, credit refusals and no new business have augmented to a mood bordering on desperation the only solution to which, according to the presidents, is a national aviation policy containing provisions for a stated level of procurement over a period of several years. Thus, the impact of V-J Day appears to have struck almost two years after its actual event. Only solution seems to be Government funds for at least a five year period, and this at the height of a Congressional economy wave!

## Industry Credit Poor

Commercial financing seems almost closed to the industry, the hearings reveal. Following last winter's disasters and recent management crises on several airlines, the banks have refused further credit to the airlines. According to bankers, if the operators of airplanes are no longer good credit risks through poor business outlook, it only follows that the suppliers of that industry are no longer good credit risks. At least one large manufacturer, ostensibly well-fortified with reserves and current production orders, is turning to the RFC for funds to meet operating expenses.

(Turn to page 82, please)



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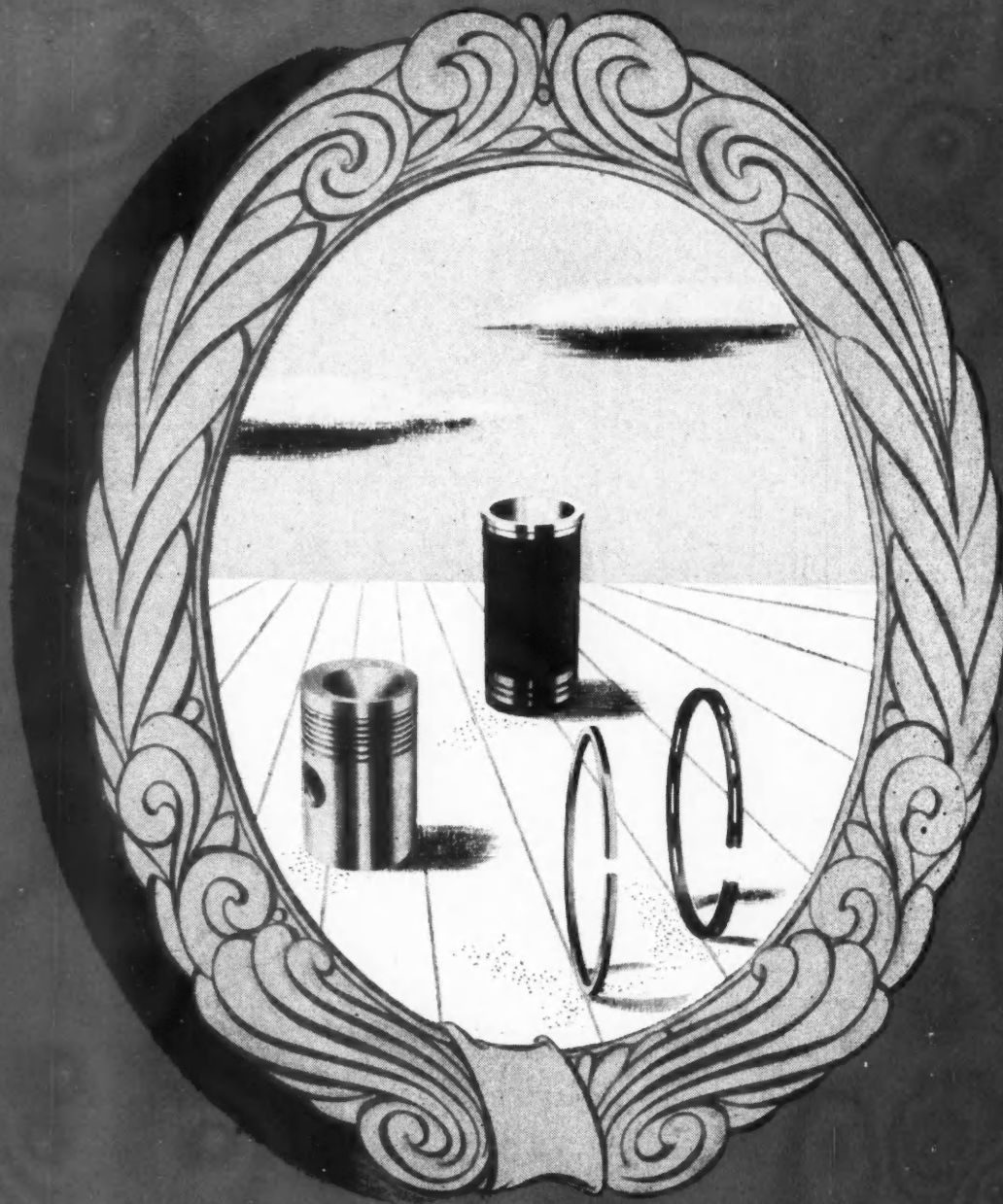
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# PUBLICATIONS AVAILABLE

Publications listed in this department are obtainable by subscribers through the Editorial Department of AUTOMOTIVE and AVIATION INDUSTRIES. In making requests please be sure to give the NUMBER of the item concerning the publication desired, your name and address, company connection and title.

## A-146—Jet Propulsion Engines

Westinghouse Electric Corp.—The Yankee line of jet propulsion engines is presented in a color booklet (B-3854). It describes the 19XB Yankee; the 9.5-A Yankee and the new Turboprop, a turbine driven propeller engine in the intermediate altitude and speed range. Design and general specification details of these axial-flow engines are included and outline dimensions are listed. Relative performance characteristics of the basic types of thermal jet engines are charted in graphic tables. Thrust, thermal efficiency, propulsive efficiency, relative weight of fuel and probable range of maximum flight speeds are considered.

## A-147—3-Phase Resistance Welding

Sciaky Bros., Inc.—Bulletin 136-A, Three-Phase Balanced Load Resistance Welding, describes the system, pictures installations and shows wiring diagrams, oscillograms, KVA demand versus throat depth for single-phase and three-phase welders, etc.

## A-148—Vapor Steam Cleaner

White Engineering & Mfg. Co., Inc.—A folder describing new Model No.

46B White Vapor Steam Cleaner. The features and operation of the cleaner, which is intended for cleaning trucks, buses, automobiles, etc., are given and a diagram showing all the parts of the cleaner is included.

## A-149—Acetylene Generators and Manifolds

Air Reduction Sales Co.—22-page, dual purpose catalog which lists and explains the complete line of Airco acetylene generators both stationary and portable, and Airco manifolds, oxygen and acetylene. A feature of the two-color catalog is the three pages devoted to diagrams which illustrate typical manifold installations and show their flexibility and adaptability.

## A-150—Sealing Compound and Thread Lubricants

The Parker Appliance Co.—Descriptive material on Oxyseal and other Parker sealing compounds and thread lubricants, for use in fluid system installations is contained in a 4-page folder, Bulletin A-45.

## A-151—Carburizing Equipment & Processes

Surface Combustion Corp.—A new 16-page bulletin, SC-134, Modern Gas

Carburizing Processes and Equipment, contains a comprehensive compilation on the subject. The well illustrated bulletin tells how modern gas carburizing is accomplished and explains the related processes of suspended carburization, carbon restoration and dry cyaniding. Charts, graphs and tables of an engineering nature, as well as many photomicrographs of steel processed by the different heat treatments are included.

## A-152—Scrap Cutter

Haller Machine & Mfg. Co.—Illustrated bulletin on the Haller Model D-611 Scrap Cutter, a compact, ram-driven unit which can be used on most punch presses. Construction features are covered in detail and complete specifications are included.

## A-153—Forging Machines and Presses

The Ajax Manufacturing Co.—Two new bulletins, 65B and 75 B. Bulletin 65B describes and illustrates air clutch operated forging machines. Photographs of the various type machines, together with specifications, information on the lubricating system and standard accessory equipment are given. Bulletin 75B contains information on Ajax high speed forging presses. The various models are described and illustrated, specifications and standard accessory equipment are included.

## A-154—Motor Truck Facts

Automobile Manufacturers Association—The first post-war edition of (Turn to page 60, please)

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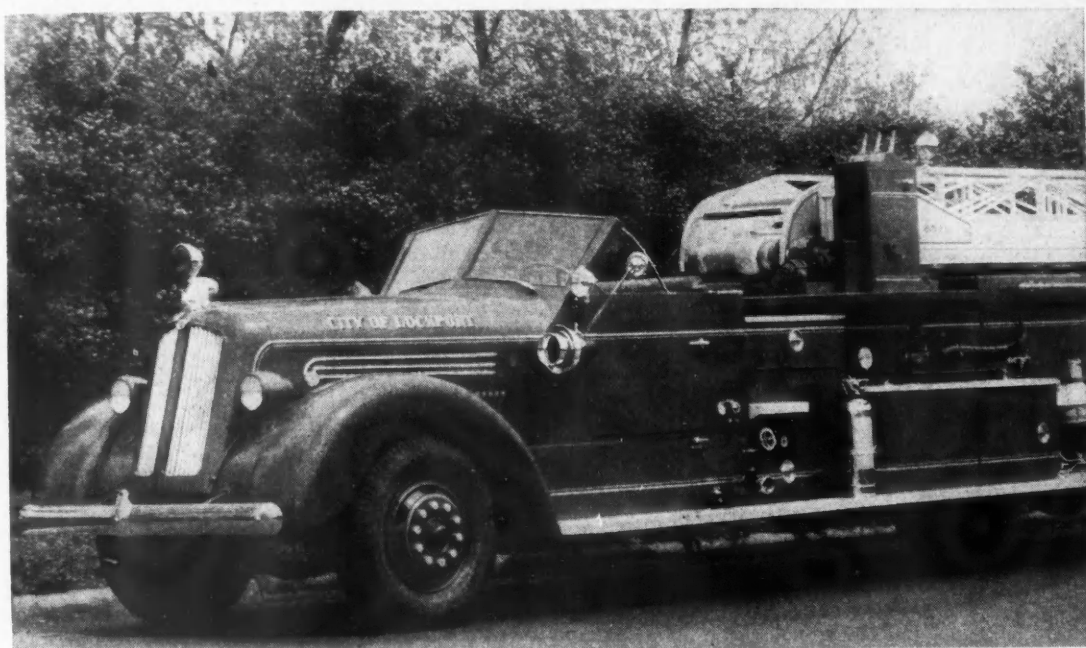
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# PERSONALS

*Recent Personnel Changes and Appointments at the Plants of Automotive and Aviation Manufacturers and Their Suppliers.*

New Departure Div., General Motors Corp.—F. W. Marschner, Executive Asst. to Milton L. Gearing, newly appointed General Mgr. George A. Smith, General Manufacturing Mgr.; Edward E. Gill, General Production Mgr.; Seth H. Stoner, Acting Chief Engineer during illness of T. C. Delaval-Crow; Robert E. Young, Director of Inspection; Joseph A. Ashwell, Director of Purchases; L. G. Sigourney, General Sales Mgr., and Robert T. Collins, Director of Personnel.

The White Motor Co.—Edward S. Reddig, Controller, elected Vice-President; Alfred D. Edgerton, Secretary of Engineering Dept., was also made Asst. Secretary of the company.

Hudson Motor Car Co.—George H. Pratt, elected Vice-President in Charge of Sales.

Ford Motor Co.—W. B. Livingston, head of bus operations; J. J. O'Neill, Asst. Mgr. of Fleet Sales Section.

Eaton Mfg. Co., Reliance Div.—Edward J. Helline, General Sales Mgr.

Boeing Airplane Co. and Boeing Aircraft Co.—Frederick B. Collins, Sales Mgr., elected a Vice-president, and Edward C. Wells, Chief Engineer, elected a Vice-president.

Allegheny-Ludlum Steel Corp.—Carl B. Pollock, Production Mgr.

E. W. Bliss Co.—E. A. Irwin, elected Vice-President in Charge of Sales, Ray H. Sullivan, Vice-President in Charge of Manufacturing. New directors are Walter F. Rockwell, Pres. of Timken-Detroit Axle Co.; M. M. Burgess, Pres. of Sheller Mfg. Corp.; Lloyd C. Irving elected Assistant Treasurer.

Thermoid Co.—William H. Weiss, Fleet Sales Engineer for the Automotive Replacement Div.

Monsanto Chemical Co., Merrimac Div.—Ivan V. Wilson, Asst. Director of Research.

Evans Products Co. — William J. Ritchie, Sales Mgr. for Western Div.

Seiberling Rubber Co.—E. B. Spoonamore, Advertising Mgr.

The B. F. Goodrich Co.—Jay E. Miller, Advertising and Sales Promotion Mgr.

Monsanto Chemical Co.—J. M. Graham, Jr., Manager of the Process Sec-

tion, General Engineering Dept., H. T. Gammon, Manager of Project Analysis Section.

Monsanto Chemical Co.—Dr. Charles Allen Thomas, Vice-Pres. and Technical Director, elected Executive Vice-President. Felix N. Williams, Vice-Pres. and General Mgr., Plastics Div., elected to Board of Directors. Five additional vice-presidents were elected as follows: J. B. Rutter, General Mgr., Merrimac Div.; Dr. C. A. Hochwalt, Director of Central Research Dept.; Wm. W. Schneider, Secretary and Head of Legal Dept.; Daniel M. Sheehan, Comptroller and C. A. Wolfe, Director of Purchases and Traffic.

General Petroleum Corp. — J. W. Templeton, Asst. to Director of Production; W. C. Lynch, Asst. to Mgr. of Industrial Relations and W. D. Joiner, Jr., replaces Mr. Lynch as Mgr. of Personnel Dept.

Caterpillar Tractor Co. — J. M. Davies, Associate Director of Research. E. W. Jackson, made Director of Parts and Service; M. T. Deames, General Parts Manager and W. Blackie, Vice-Pres. and Chief Administrative head of Accounting and Merchandising Depts., has also assumed administrative guidance of Traffic Dept.

The Russell Mfg. Co.—Lyman B. Brainard appointed Sales Mgr.

Lord Mfg. Co.—Dr. Stephen J. Zand, Vice-President in Charge of Engineering.

Gerity-Michigan Die Casting Co.—John J. Krez, elected to the Board of Directors.

Warren City Mfg. Co.—Tony Reiterberger, Asst. Chief Engineer.

Wilson Foundry & Machine Co.—J. G. Paule, appointed Vice-President and Asst. General Mgr. Myron Hill will succeed Mr. Paule as Secretary and Treasurer.

Continental Aviation and Engineering Corp.—Continental Motors Corp.—George E. Winters (Continental Motors Corp.) elected Executive Vice-Pres. Lloyd Morrow (Continental Motors) elected Vice-Pres. in charge of automotive engine div. Frank H. Mull (Continental Motors) Vice-Pres. in charge of shop control div. H. M. Parker (Continental Aviation) elected a director and W. G. Raven (Continental Aviation) made Secretary.

The Steel Improvement and Forge Co.—A. H. Milnes, Chief Engineer.

Ajax Flexible Coupling Co., Inc.—Robert G. Cady, Manager of Materials Handling Div.

Doman-Frazier Helicopters, Inc.—G. N. Montgomery, Sales Engineer.

## Publications Available

(Continued from page 58)

Motor Truck Facts has been issued. Statistical information is given on production, registrations, taxes, use of trucks, highway standards, etc. Copies available from Automobile Manufacturers Assoc., New Center Bldg., Detroit, from AUTOMOTIVE and AVIATION INDUSTRIES.

### A-155—Midget Mills

Severance Tool Industries, Inc.—Specifications and pictures of the complete line of Severance Midget Mills are given in Catalog No. 16. Comprising 28 pages, the catalog contains information on the five principal Severance tool types: midget mills; deburring group; tube cutter group; countersink group and miscellaneous types, including gear tooth rounders, edging mills and hand and carbide files. Tables of recommended cutting speeds for the various tools are included.

### A-156—Controlled-Air Power

Bellows Company—Bulletin on Controlled-Air Power describes the use of this method in replacing repetitive manual operations in a wide range of

manufacturing processes, shows specific applications, etc.

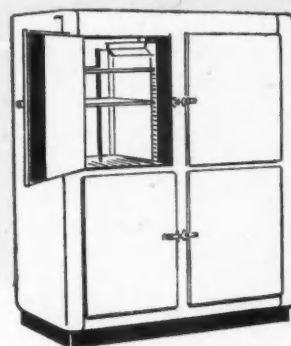
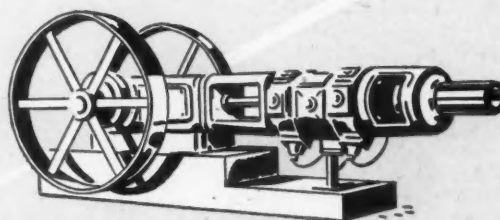
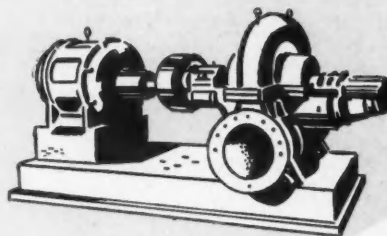
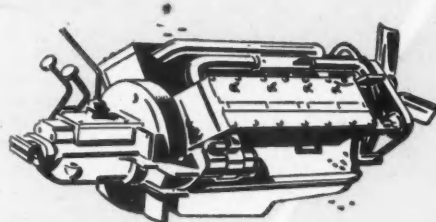
### A-157—Glycols

Carbide and Carbon Chemicals Corp.—Booklet on Glycols gives in detail the properties, specifications and uses of ethylene, diethylene, Kromfax solvent, triethylene, etc. In 30 charts it gives such information as physical constants, comparative evaporation rates and solubility data. It also includes 94 literature references to the glycols. Booklet is identified as Form 4763.

### A-158—Chucking Machine

Hardinge Bros., Inc.—A new bulletin has been issued giving complete information on the company's Multi-Operation Chucking Machine. Various operations are described and illustrated. Blue prints of parts and typical machine set-ups, together with photographs of precision parts produced on the machine are given. A full-page blueprint of tooling dimensions and floor plan, and one giving the machine specifications and regular equipment are included. Accessories used in the various operations are illustrated and described.





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## High Octane Gas and The V Engine

(Continued from page 32)

under the hood between the radiator and the dash. Also, because of the shorter length of the V engine, the rear seat of the car can be moved forward, ahead of the axle, and thus made more comfortable.

The objection often has been raised that the V-type engine makes parts less accessible. It is, of course, fundamental that if the space under the hood

is reduced, the engine accessories will have to be moved closer together, which might be expected to interfere with accessibility. However, by careful design the V engine can be so arranged that practically all parts can be readily approachable. Almost every car has a few parts that are not as conveniently located as would be desirable, but this applies to in-line as well as to V engines. In one early V model the distributor was too close to the radiator, which made it awkward to service. But this has since been remedied. Certain parts, such as the generator and fuel pump, which are located in the "trough"

of the engine or driven from the camshaft located there, are actually more accessible in the V.

A few notes on the history of eight-cylinder V engines may be of interest. The first engine of this type of which there seems to be an authentic record is the French Antoinette, which was designed to power speed boats and aircraft. It appeared about the turn of the century. Incidentally, the eight-in-line type is nearly as old, the first engine of this type having been built by the French firm of Charron, Girardot & Voigt in 1902. It powered a "gearless" car which was started and operated in direct drive exclusively. This early attempt to do away with the transmission does not seem to have met expectations, for the car did not go into production. Rolls-Royce, Ltd., in England in 1905 produced what was known as the Legalimit car, powered by a V-eight, and in 1907 the Hewitt Motor Co. built and exhibited at the New York automobile show a car powered with a 50-60 hp engine of this type. None of the V-eight models so far mentioned went into regular production. One thing that handicapped them was that multi-spindle boring and grinding machines had not yet been developed. The cylinders usually were cast singly and had to be machined individually, which made the engines rather expensive. The first stock model with a V engine that was continued during several seasons was the DeDion-Bouton brought out in France in 1909.

In the American passenger-car field the V engine first gained prominence when it was adopted by the Cadillac Division of General Motors Corp. in 1914. Cadillac quite early had gained a reputation for high-class precision workmanship and high quality construction throughout, and this enabled it to continue to sell its original single cylinder model after most other makers had switched to the two, three or four cylinder. The firm therefore changed directly from the single to the four-cylinder model, and later directly from the four to the eight cylinder, bypassing the popular six. Later it took a similar step in bypassing the twelve and bringing out a sixteen.

All of the earlier V-eight engines had single-plane crankshafts of the same general design as that of the conventional four-cylinder crankshaft. In such an engine the primary inertia forces cancel out, but the secondary forces on the reciprocating masses in the two cylinder banks combine to produce a sideward or lateral shaking force. This is illustrated in Fig. 2, where the crank is shown in the top dead-center position for the right-hand cylinder. With the crank in this position the secondary inertia force is at its maximum and directed upward along the cylinder axis. With the left-hand cylinder the crank is 90 deg past top center, and since the secondary inertia force has twice the frequency of crankshaft rotation, that force due to the reciprocating parts in the left-

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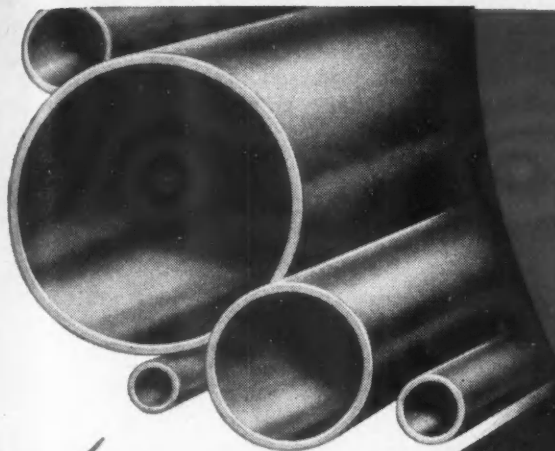
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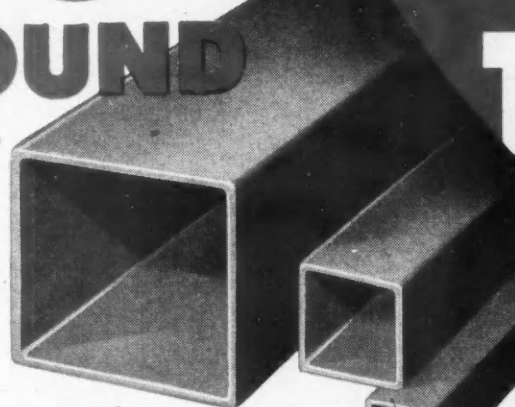
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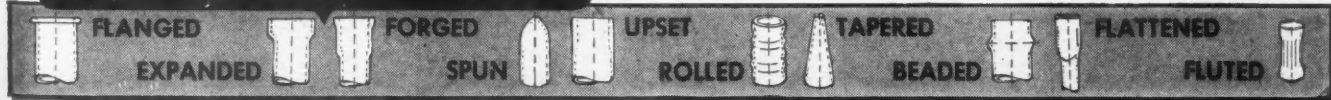
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hand cylinder is 180 deg behind (or directly opposed to) that force due to the parts in the right-hand cylinder. Consequently, it is directed downward along the cylinder axis, as shown by the arrow. The resultant of these two forces is a horizontal force through the crankshaft center, as shown. The arrow indicates the value of the force for this particular crankshaft position. As the crankshaft rotates, the force varies in magnitude and changes its direction, thus constituting a horizontal shaking force.

When this shaking force came into resonance with the natural period of

transverse vibration of the forward end of the chassis it produced a rather unpleasant sensation. In the early Cadillac this occurred at about 55 mph. This, unfortunately, was a speed seldom reached at that time, when modern hard-surfaced roads were still relatively rare. But a few years later cars with eight-cylinder in-line engines appeared on the American market. It is true that the first of these, the Duesenberg, was not perfectly balanced either. It had a crankshaft which consisted essentially of two four-cylinder crankshafts joined end to end, throws 1 to 4 being in one plane and throws

5 to 8 in a plane at right angles thereto. With this type of crank the reciprocating parts in the four forward cylinders produced a secondary shaking force, and those in the four rear cylinders the same. As there was an angle of 90 deg between the planes of the two parts of the crankshaft, there was a phase difference of 180 deg between the two shaking forces, and the final result was a secondary rocking couple.

In all later eight-in-line engines this rocking couple was eliminated by making use of what is known as a 2-4-2 arrangement of the crank throws, throws 1, 2, 7 and 8 being located in one plane and throws 3, 4, 5 and 6 in a plane at right angles thereto. That an eight-cylinder V engine can be completely balanced had been known for a long time, the principle having been explained in a book on Engine Balancing by Archibald Sharpe published in England in 1907. It is necessary to locate throws 1 and 4 in one plane and 2 and 3 in a plane at right angles thereto. Primary inertia forces then combine to produce constant rotating forces which can be balanced by suitable counterweights, while all secondary inertia forces cancel out. When the crankshafts are dropforged, all throws are forged in the same plane in the first place, and the forging is then twisted or "indexed" to bring the individual throws into the proper planes. The need for this indexing operation and for rather heavy counterweights on two of the crank arms undoubtedly was the reason the two-plane crankshaft was looked upon with disfavor for a long time, but the competition of the six and the modern straight eight finally forced its adoption.

A diagram of a two-plane crankshaft for an eight-cylinder V engine is shown in Fig. 3. As regards the primary inertia forces, consider crank throw 1 and the reciprocating parts attached thereto, which reciprocate in cylinders at right angles to each other. The primary force due to one set of parts may be represented by the expression  $F \cos a$ , where  $a$  is the crank angle measured from the top dead center position. That due to the parts in the other cylinder will then be  $F \cos (a + 90^\circ) = F (-\sin a)$ . The resultant of the two is

$$\sqrt{F^2 (\cos^2 a + \sin^2 a)}$$

But

$$\sqrt{\cos^2 a + \sin^2 a} = 1,$$

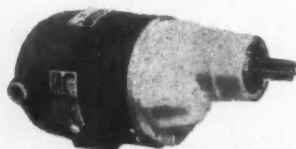
hence the resultant is equal to  $F$ . In other words, the resultant primary force has a constant value  $F$ , the same as the maximum value of the primary force due to the reciprocating parts of one cylinder; it always acts in the direction of the crank arms, rotating with the crank, and therefore can be neutralized by counterweight and secured to the crank arms. The primary inertia forces acting on crank throws 2, 3 and 4 can be neutralized in the same way, but instead of securing

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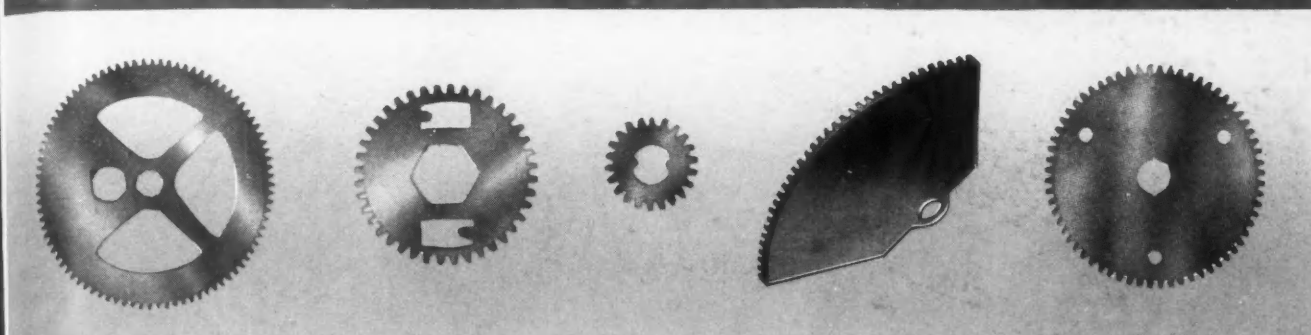
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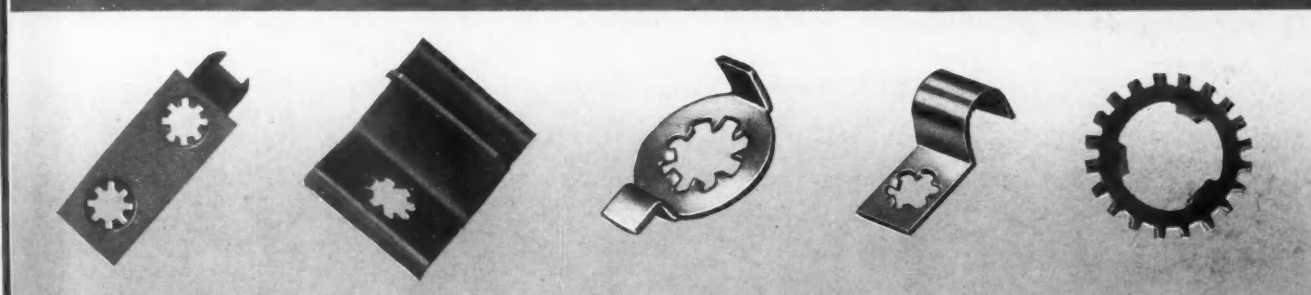
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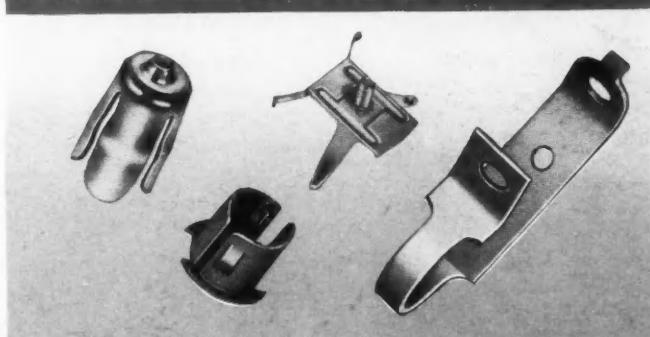
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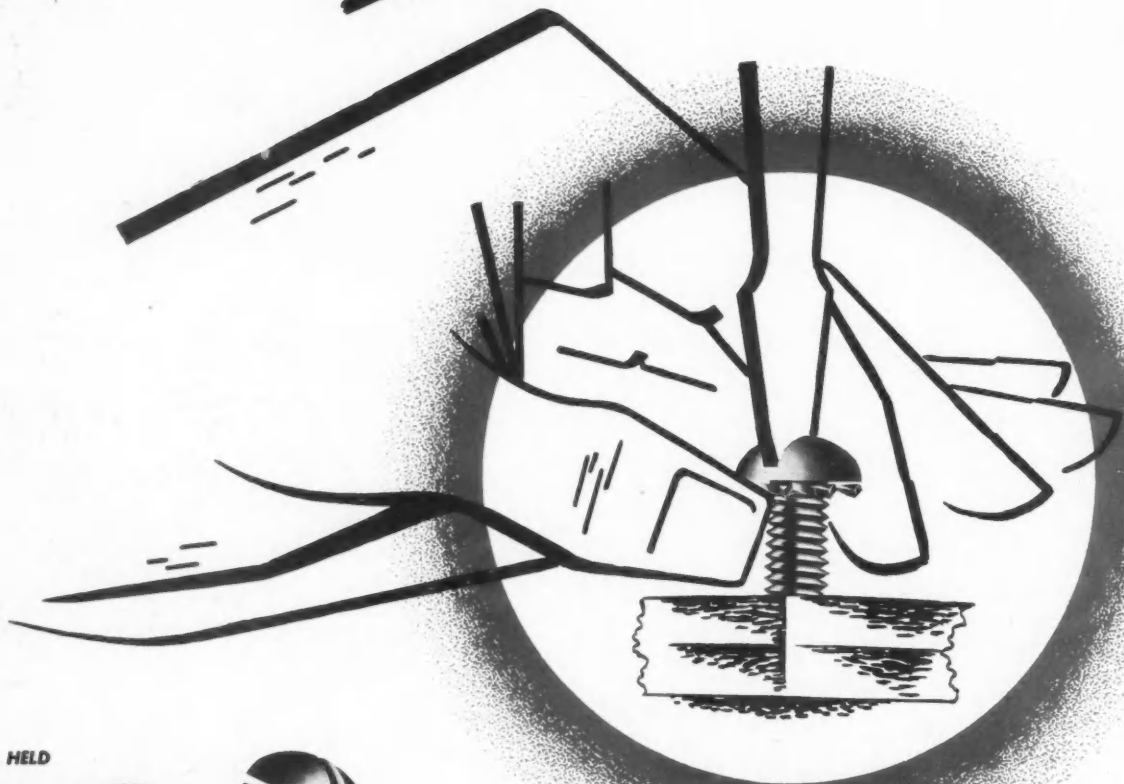
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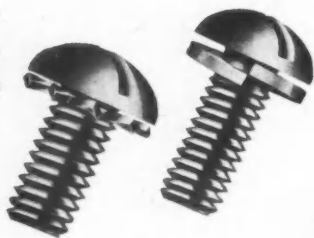
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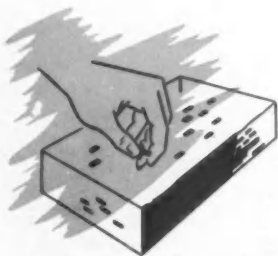
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counterweights to all crank arms, a single counterweight is secured to a common arm of throws 1 and 2 (C<sub>1</sub>) and another to a common arm of throws 3 and 4 (C<sub>2</sub>). As these counterweights must balance not only the rotating but also the reciprocating parts, they must be larger than where only rotating parts need to be balanced.

Secondary forces on the reciprocating parts of each bank of four cylinders neutralize each other. Referring to Fig. 3, since crank throws 1 and 4 are diametrically opposed, there is a phase difference of 360 deg between the secondary forces on their respective reciprocating parts; in other words, these forces are in phase, and they may be represented by a force equal to their sum acting at the midpoint of the center bearing. Crank throws 2 and 3 also are spaced 180 deg, and their secondary inertia forces are in phase and may be represented by a force equal to their sum and acting at the midpoint of the center bearing. Since there is an angle of 90 deg between throws 1 and 2, the phase angle between their secondary inertia forces is 180 deg; that is, the two are diametrically opposed. The same holds with respect to the secondary inertia forces of the reciprocating parts acting on throws 3 and 4. The distribution of these secondary inertia forces along the crankshaft therefore is shown in Fig. 4. It can be seen that they cancel out completely. The secondary inertia forces due to the reciprocating parts of the other cylinder block cancel out in the same manner. Thus both the rotating and the reciprocating parts of a V-eight engine with this type of crankshaft are completely balanced, at least as far as the first two harmonics of the inertia forces are concerned, which are the only ones of any significance.

## Processing Torsion Bars

(Continued from page 52)

are Brinell tested for uniformity of hardness by a special sampling procedure. This consists of testing five bars from each pallet—one bar from each corner and a fifth bar from the center of the stack. Each sample bar is tested at both ends and occasionally at points in the center section.

Last step in the process is shot peening to increase the fatigue life which is said to be seven times that of an untreated bar. In preparation for this the rough spots on the forged ends are ground off and the bars are straightened. Shot peening is done in the American Wheelabrator machine, Fig. 3. As shown, the conveyor is fitted with revolving rubber "hour-glass" shaped spindles for carrying work through the machine. The entire surface is thus uniformly treated, the operation also removes any scale that may have been left on the surface from preceding operations.



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8 x 8	12 x 12	14 x 30	18 x 24	24 1/4 x 24 1/4
8 x 10	12 x 14	14 x 32	18 x 30	25 1/2 x 24
8 x 12	12 x 16	14 x 36	19 x 15	27 1/2 x 38 1/2
8 x 14	12 x 18	16 x 14	19 x 16	28 x 24
8 x 18	12 x 20	16 x 16	19 x 34	29 x 20
8 x 31	12 x 24	16 x 18	20 x 15	29 x 23 1/2
8 3/4 x 10	12 x 30	16 x 20	20 x 17	30 3/4 x 15 1/2
8 3/4 x 10 1/2	12 x 64	16 x 24	20 x 20	33 1/4 x 21
9 1/4 x 17 1/2	12 x 32	16 x 27	20 x 30	36 x 30
10 x 10	12 1/2 x 14	16 x 30	20 x 34	36 x 36
10 x 12	14 x 12	16 1/2 x 17	20 x 80	38 1/2 x 40
10 x 12	14 x 14	17 1/2 x 12	20 1/2 x 24	41 1/2 x 32
10 x 14	14 x 16			

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# NEW Products for AIRCRAFT

(Continued from page 50)

the Consolidated B-36 and the Northrup Flying Wing (B-35). Four generators, or alternators, were built for the B-36 and three supply the electrical needs of the Flying Wing.

Weight economy and more efficient trouble-free operation, especially at high altitudes, are said to be the chief advantages of the alternating current

system. Operating at higher voltages, 208 compared with 30 volts for direct current, the alternating current system uses smaller wires. This means less copper and, consequently, less weight. Alternating current also permits the use of induction motors which have no commutator brushes.

Designed and built by Westinghouse

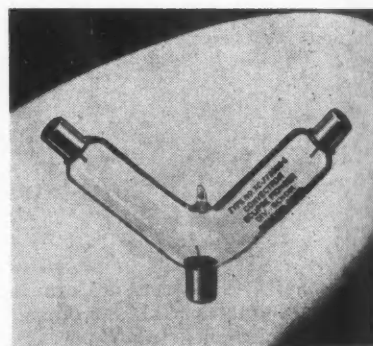
in cooperation with the Army Air Forces, the generators weigh a little less than 75 lb and are only 19 in. long and 9 in. in diameter. They are driven from the main engines through a constant speed drive at 6000 rpm. At this speed, each generator produces 40 kva. Improved performance was achieved through new heat-resisting insulation, combined with a system of blast-cooling.

The availability of a-c systems does not mean that these will be used on all large aircraft. Direct current still will be preferable for some applications. In selecting a system best suited to a particular machine many factors must be considered. These include such things as the size and electric power requirements of the aircraft, installation weight, fuel consumption, reliability, maintenance problems and, for military planes, the probability of reaching an objective.

## C-88—Position Convectron

A small control device known as a Convectron tube, which offers new possibilities as a vertical sensitive element, has been brought out by Eclipse-Pioneer Division, Bendix Aviation Corp., Teterboro, N. J.

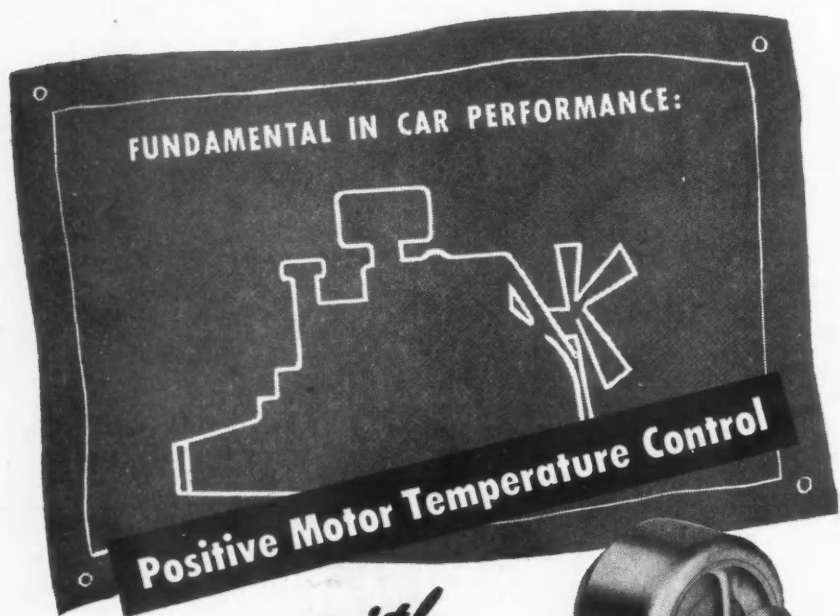
The Y-shaped, gas filled tube, is capable of giving an appreciable signal relative to its position about vertical.



Convectron tube

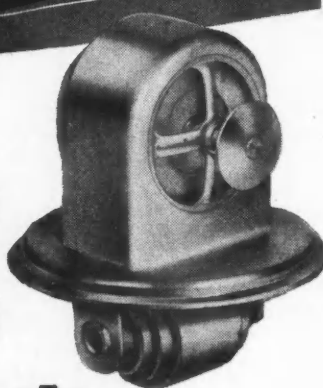
Since the signal has sense as to whether displacement is to the left or right of null, the tube can be used for control of servo mechanisms and instruments. The signal is dependent upon the rate at which gas convection currents leave a heated filament and rise along the vertical, and the angle that the filament makes with the vertical.

Owing to the fact that the tube has no moving parts and that the signal is obtained directly without oscillation, this Y-Type position Convectron overcomes some of the problems inherent in the old methods for obtaining vertical reference.



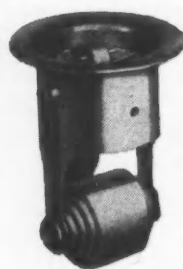
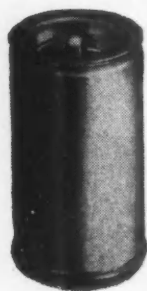
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## Thermostats

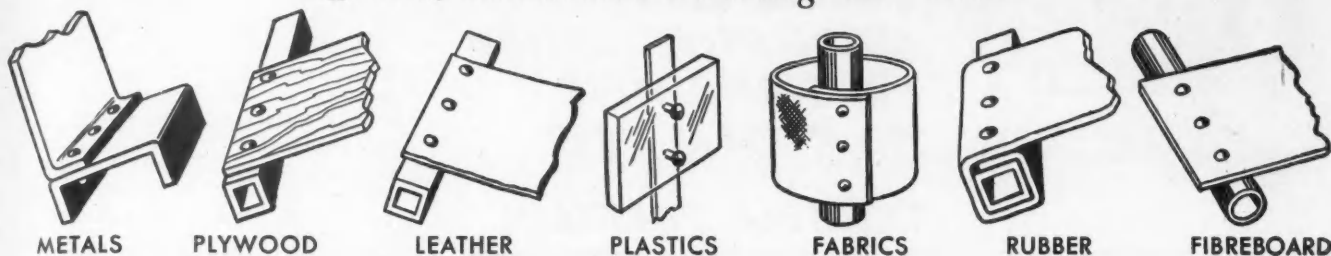
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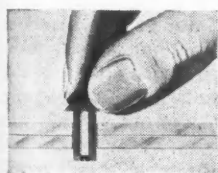
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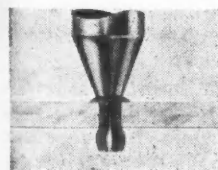
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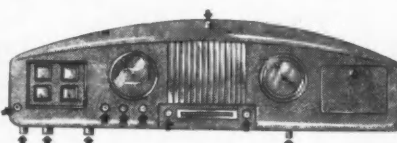
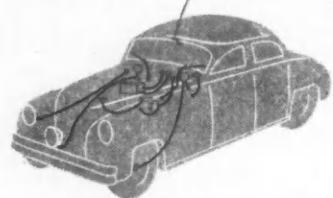
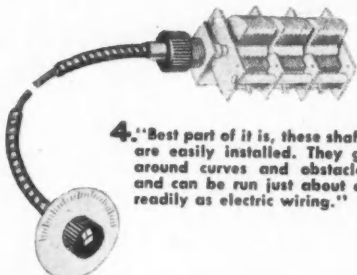
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(Continued from page 29)

placement and from 223 to 276 net hp from 2200 to 2000 rpm. The three engine models are available with equipment for use with either gasoline or butane-propane-natural gas fuels. Model 400 is reputed to have the highest developed horsepower rating of any truck engine in current production.

The three principal design features of all models are as follows:

1. Overhead valves and overhead camshaft permitting a perfectly-balanced, semi-spherical, machined combustion chamber. The camshaft is driven by a chain from the accessory shaft which in turn is gear driven from the rear of the crankshaft just ahead of the flywheel. This feature is said to virtually eliminate torsional vibration on the accessory drive chain and to be unique in the industry.

2. Twin ignition available either with 12-point distributor for straight battery operation or with battery and magneto system.

3. A replaceable cylinder block is fitted between the cylinder head and the upper crankcase assembly. This eliminates the need for cylinder sleeves and is available on a factory exchange basis at a substantial saving over the replacement cost for a complete upper crankcase and block as required in most standard engines. Bore and height of this replaceable unit constitutes virtually the only difference between the three models.

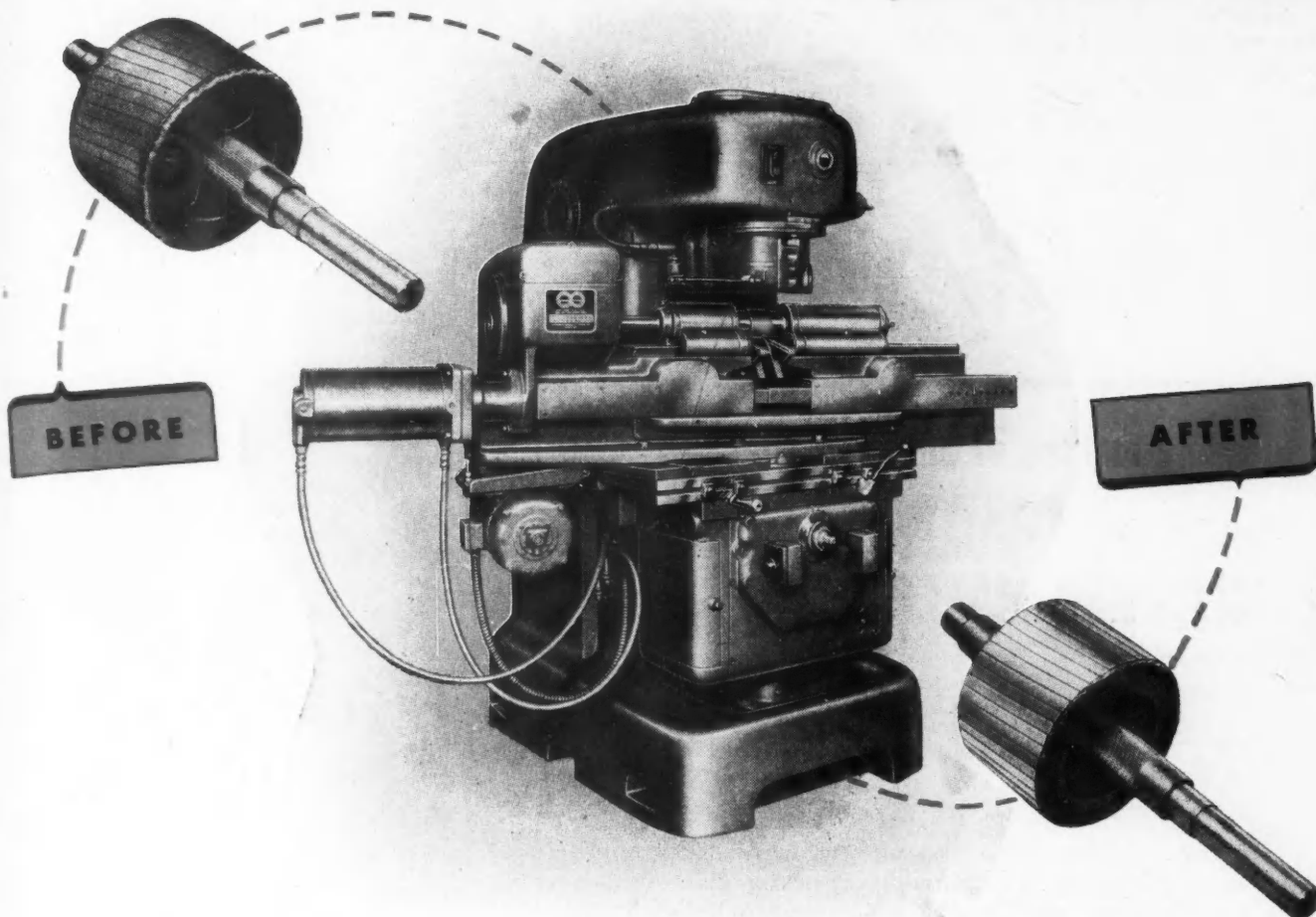
The same accessory shaft which drives the camshaft chain continues to a point just forward of center from which a spur gear drives the distributor. From the same point a gear train goes out to an external shaft which drives the air compressor at one end, the generator at the other. Only the six-blade fan and the water pump are driven by the dual belts at the forward end. The governor, of Hall-Scott design and manufacture, is driven from the camshaft. A 12-volt generator is standard.

A 2½-in. Zenith up-draft four-venturi carburetor is standard on the gasoline models, while the regulator for gaseous fuels is made by the American Liquid Gas Corp., Los Angeles.

Dual horizontal oil filters and a water-cooled oil cooler, both mounted at the front right side are standard. It will be noted that the intake manifold is on the left, exhaust on the right with a heating duct across the top of the engine on the gasoline-powered engines only.

The alloy-steel, heat-treated crankshaft has seven main bearings, 3¼ in. in diameter with length ranging from 1 19/32 in. to 3 1/8 in. Slip-in precision bearings are of steel-back, copper-lead construction.

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71

## Cadillac's Modernized Foundry Facilities

(Continued from page 27)

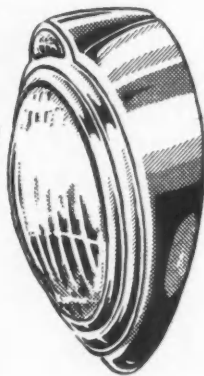
room which is located at the north end.

The most modern equipment available feeds materials into the cupolas. A five-ton bridge crane with electromagnet lifts steel, pig iron and scrap into a weigh car beneath the first floor. Coke and limestone from overhead bins are added. The charge is then dropped from the weigh car into a skip hoist.

The hoist rises from the basement to the charging area, where it automatically unloads into the cupola. With this equipment one cupola can be charged by two men—a crane operator and a weigh car operator. This eliminates the necessity for men to work in the smoke, gas and heat of the charging zones.

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After the metal is melted, the cupola is tapped and the metal runs continuously into a holding ladle. Electric crane ladles on a monorail carry the molten iron to pouring stations on the molding floors. These crane ladles can be filled from the holding ladles without plugging the tap hole of the cupola. Cylinder block molds are poured directly from the electric crane ladles. Molds produced on three other conveyor lines are poured from hand ladles.

Each of the four molding conveyor lines—cylinder block, small hard iron parts, large soft iron parts and small soft iron parts—is equipped with a separate sand system. This provides sand most suitable for the type of casting made on each line. Sand slingers are used on both hard iron lines while jolt roll-out squeeze machines are used on the soft iron lines.

Cylinder blocks and transmission case castings are transported from shakeout by monorail to the cleaning room. Cylinder blocks go through a stress-relieving furnace, allowing all sections of the castings to cool uniformly. Castings automatically enter a wet tumbling mill and are tumbled for 59 ft. This removes sand left on the castings and furthers the cleaning process. Emerging from the tumbling mill, they are automatically deposited on a slat conveyor, where they are sorted into containers through individual chutes. Here gates and sprues are removed and placed on a bucket monorail for delivery to scrap metal bins.

After sorting, the castings are put through a Wheelabrator or Rotoblast and then continue on their way to grinding and inspection lines. After grinding and careful inspection, the castings are ready for shipment.

Through worker comfort and the elimination of most of the usual manual tasks associated with old-time foundry practice, Cadillac hopes to attract a better type of worker, particularly the younger men who have possibilities of acquiring new skills. In this fashion it is anticipated that foundry quality can be placed on a higher plane than ever before.

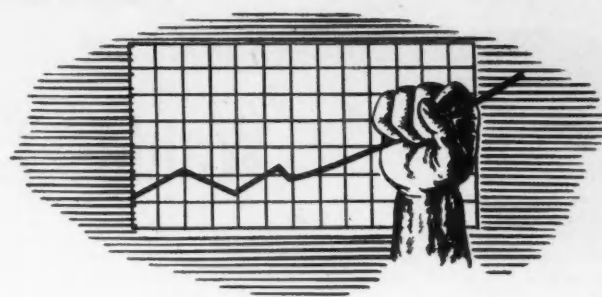
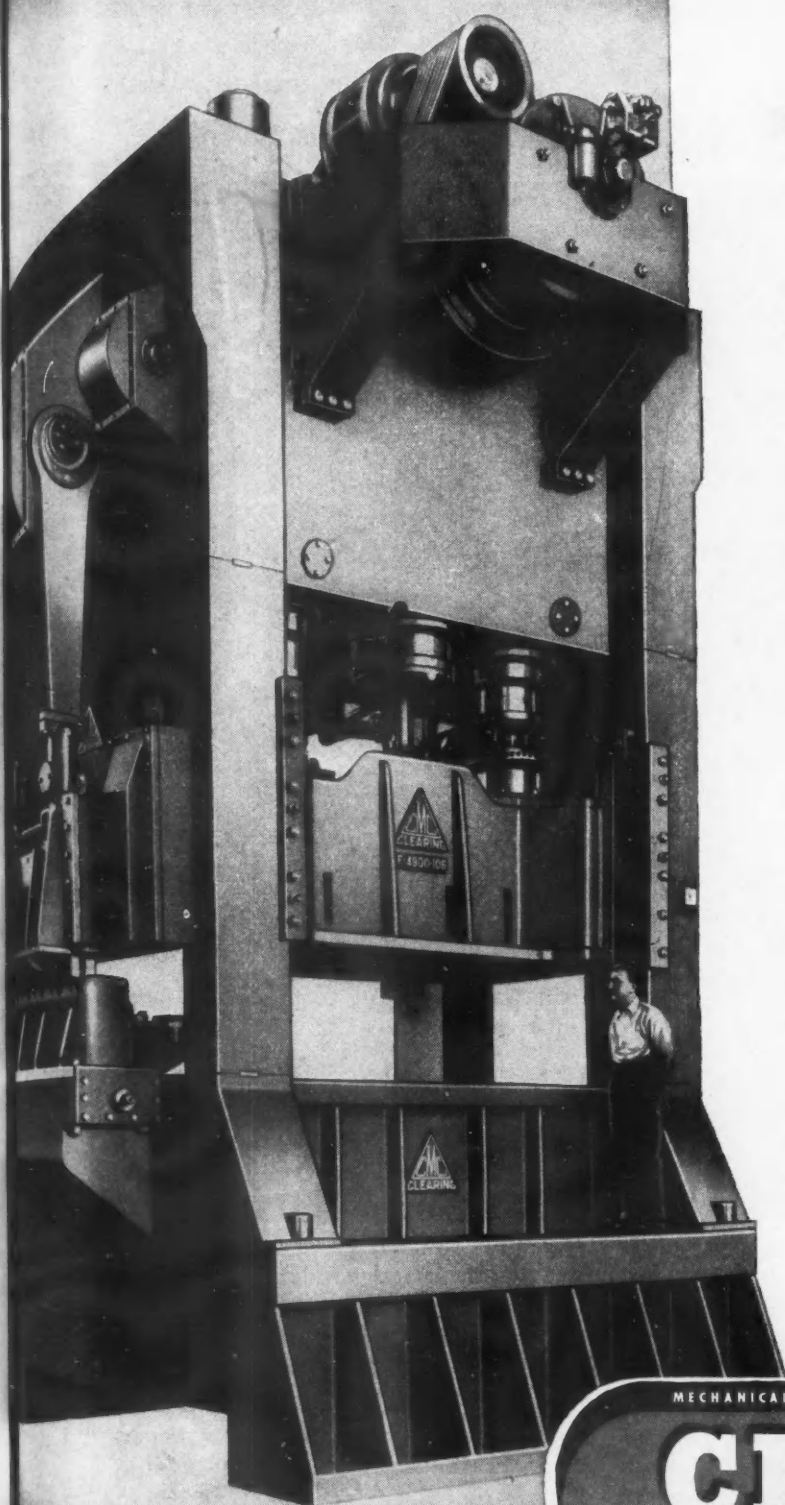
Quality control stems from the operation of a well-equipped metallurgical laboratory charged with responsibility for sand analysis and control, chemical and physical testing of raw materials of every kind, and a check analysis of the melt from every ladle.

### Body Engineers Meet in November

The American Society of Body Engineers are going to hold their Second Annual Technical Convention in Detroit, Nov. 5 through 7. Technical sessions will be held in the mornings, afternoons and evenings, and display booths are to be provided for manufacturers of automobile body material and equipment.



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## SPEEDING PRODUCTION with a 900-TON Push

Automatic feed, high speed production is not new or unusual in blanking operations—but when the blank is 27" in diameter and the stock is .90 carbon steel,  $\frac{3}{16}$ " thick, it ceases to be an ordinary job. Clearing built this press to just those specifications, and the press is now delivering for its owner at 36 strokes per minute. Besides the blanking, the press cuts the scrap as it emerges, thus saving a separate operation and further reducing production costs.

Here's a 900-ton press working with the accuracy and speed you might expect in a much smaller machine. Clearing has been able to achieve results like this because from the day it was founded Clearing has refused to be hampered by conventional but unsupported beliefs. That's why you'll find Clearing presses in the most modern, most efficient plants throughout the world. It's also why a Clearing press is invariably a profitable investment.

Whatever your problem—whether you require a giant machine or a small inclinable press—put your facts and requirements in the hands of Clearing engineers for the most satisfactory and profitable answer.



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# Waldes TRUARC retaining rings

## 2 MINUTES vs. 2 SECONDS!



This skilled assembler is using a screwdriver and six screws to install a collar. Each of the many light streaks indicate another time-consuming arm-motion; with less efficiency and greater fatigue.



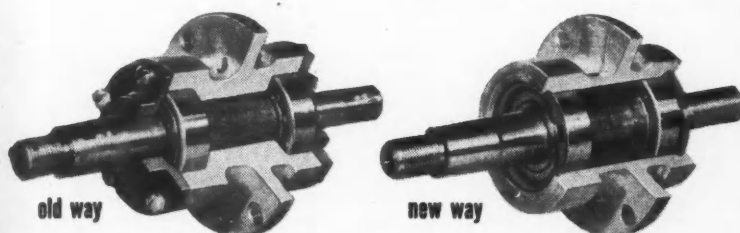
Same unit, same worker. But a simple redesign has substituted a Truarc ring for the collar and screws. He uses one tool—a pair of Truarc pliers. A single light streak means fewer arm-motions.

Right before your eyes is visual proof of how much assembly time can be cut. It's done simply by replacing conventional fastening devices with Waldes Truarc Retaining Rings. Less time is required for job-training, because Truarc guarantees accurate relationship of parts independent of the skill of the assembler. Inspection is simplified, rejections reduced—and the product will function longer without repair.

This new fastening does wonders for machine design. Truarc rings mean lighter weight, less bulk, maintenance of tolerances. Production and maintenance men find Truarc cuts labor and material costs wherever used. Its unique taper design assures constant circularity. Its never-failing grip assures a better job of holding machine parts together. Yet Truarc rings are easily removed and re-installed in a few seconds.

# slash assembly time, cut costs

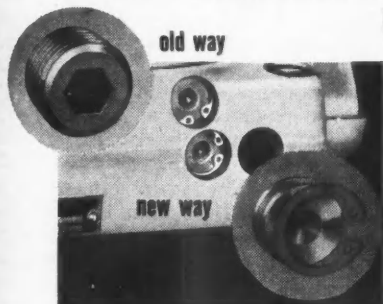
## Typical cost-cutting applications:



### TRUARC TRIMS 13 MINUTES' MACHINING TO 6

Permits redesign of exhaust-fan bearing-housing for M. & E. Manufacturing Company, Indianapolis. Truarc cuts assembly time 66%, trims 25% off weight of unit, lowers labor and material costs.

### TRUARC ELIMINATES 12 OPERATIONS, CUTS UNIT COST 65 CENTS



Changeover to Truarc in hydraulic Powerpak cuts assembly time over 50% for Electrol, Inc., Kingston, N. Y. Permits use of semi-skilled assemblers, cuts maintenance time more than half.

Your designs can easily be adapted to secure Truarc's advantages. See what can be done for your product: send your drawing to Waldes Truarc Technical Service Engineers for individual attention, without obligation.

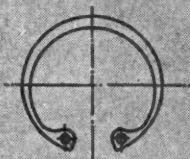


**WALDES**  
**TRUARC**  
Reg. U. S. Pat. Off.  
**RETAINING RINGS**

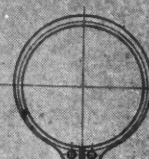
WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK  
Canadian Distrib.: Controlite Engineering & Sales Ltd., 20 Bloor Street W., Toronto 5

WALDES TRUARC RETAINING RINGS ARE PROTECTED BY U. S. PATS. 2,302,948; 2,026,454; 2,416,852 AND OTHER PATS. PEND.

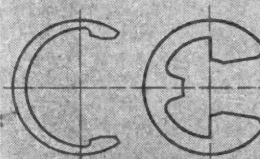
## THERE ARE DIFFERENT TRUARC RINGS FOR ANY APPLICATION:



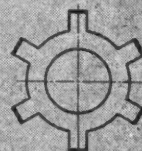
**STANDARD.\*** Replaces bulky, complicated devices; simplifies assembly.



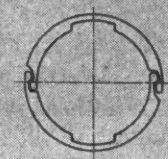
**BEVELED\* and BOWED.\*** Absorb end-play rigidly or resiliently where tolerances accumulate.



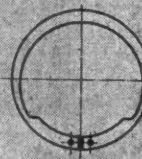
**CRESCENT and E-RING.** Snap on radially where axial assembly is impossible. Give firm grip.



**SELF-LOCKING.\*** Economical where thrust is moderate — housing requires no machining.



**INTERLOCKING.** 2-piece ring for heavy thrusts, positive lock against high RPMs and vibration.



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## More Efficient Utilization of Fuels

(Continued from page 39)

cylinder tests. If a triptane engine had been built, the ratio would have been considerably higher—probably 15 or 16 to 1.

The engine was designed according to rather conventional procedures except that it was made rigid enough to carry the higher loads imposed. Diesel experience helped greatly on this problem because the stresses involved are comparable. After it was found that there were no special difficulties from roughness and high friction on the first

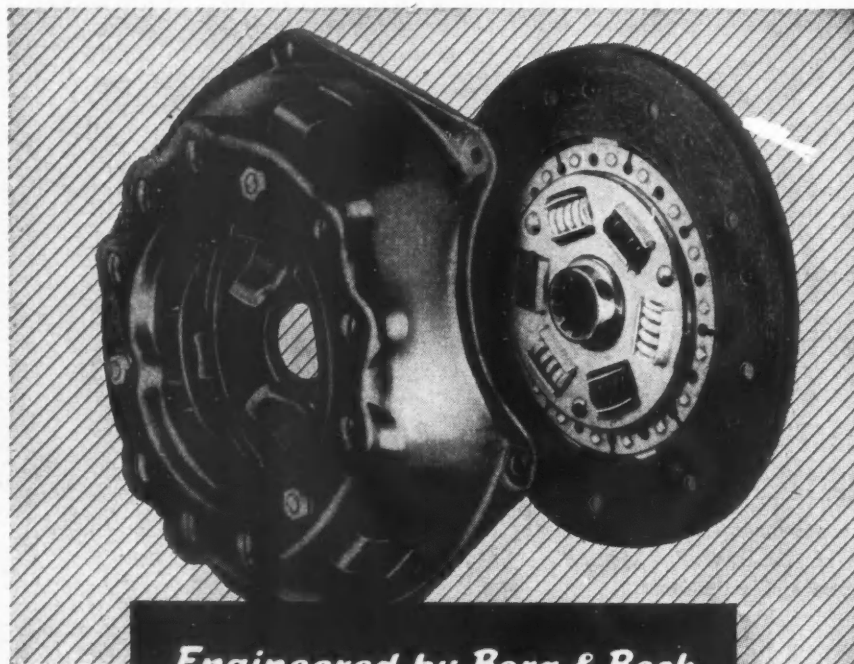
experimental engine, a second experimental design was made, following conventional practice. This new engine, designed from experience in the high-compression project on both the single and original six-cylinder engine, weighed no more per hp than stock engines. The hp of this new engine was comparable with only slight differences to that of a 1946 stock production engine. The bmep was, of course, very much higher on the high-compression engine at all speeds, since it was only

181 cu in. displacement compared with 238 cu in. on the stock engine. Volumetric efficiency of the high-compression engine was as good or better than the stock engine at all speeds, showing that there was no restriction to engine breathing. The stock engine had a maximum bmep of 109 psi at 1250 rpm and the high-compression engine, a maximum bmep of 130 psi at 1759 rpm. These tests were made in the "as installed" condition with muffler, tail pipe and all accessories and corrected for barometer, temperature and humidity accordingly. A minimum specific fuel consumption of less than 0.40 lb of fuel per bhp hr was obtained for the high-compression engine in comparison with 0.54 for the stock engine. This was a gain of about 35 per cent which checked very well with the single cylinder data tests. It is also comparative with full throttle Diesel fuel consumption, showing that, at equivalent high compression ratios, it makes little difference whether there is compression ignition or spark ignition. Both types of engines give high full-load fuel economies.

The six-cylinder, high-compression engine was installed in one of two of the same model stock automobiles, both equipped with Hydra-Matic transmissions. These two cars, the one with the standard engine and the one with the high compression engine, were run on comparative road tests for many months. Both the car with the standard engine and the high-compression engine gave normal, smooth operation. A short drive showed that the performance and feel were just about the same as a production car, and it was impossible to tell from driving the two cars which one was which, except at high speeds where the high compression car was somewhat faster. It should be remembered that the output of the high-compression engine was made to match the same performance as the standard engine. The factor that cannot be demonstrated on a short run in the car is the greatly increased economy.

In constant speed level road tests of the high compression and standard cars, the high compression car gave from 35 to 40 per cent better economy in mpg than the standard car. At 40 mph the standard car had a fuel economy of 18.5 mpg while the 12.5 compression ratio car had an economy of 26.5 mpg, an improvement of approximately 40 per cent. At 60 mph the saving was 35 per cent.

In order to determine the actual gain in economy a number of cross-country trips were made where both cars were driven together under the same speed and traffic conditions. On a large number of such trips under widely varying road conditions the average gain in economy was about 33 per cent. Where the maximum speed was held below 50 mph, the gain was 35 per cent. In the same test made with the maximum speed limit to 70 mph, the gain was 33 per cent. Several extended trips made



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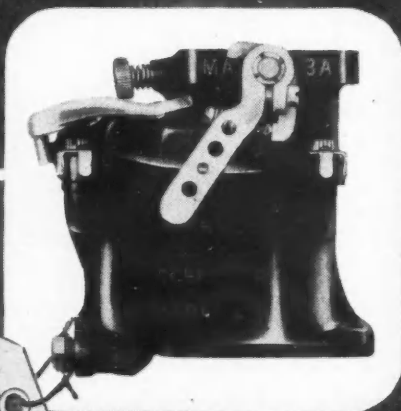






# Thrifty

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entirely in city traffic showed gains of over 40 per cent, which is of major importance in view of large quantity of fuel burned under these conditions.

Many of the preconceived troubles which were expected failed to materialize after the engine was running. Engine roughness was eliminated by proper structural design. With some modification of the ignition coil winding and core material, conventional six-volt ignition proved adequate on this engine. Cold starting was not a problem at temperatures encountered in the Detroit area during the past winter. It was thought that the effect of combustion chamber deposits might become critical at high-compression ratios. Almost 10,000 miles of driving with a leaded fuel has failed so far to develop any trouble. It was possible to operate this 12.5 compression engine with 99/87 octane number gasoline, although with some slight detonation at speeds above 55 mph. With comparatively small changes in spark advance, an engine of this type can be operated satisfactorily over the entire speed range with a fuel of approximately 99/87 octane number.

### Fluid Couplings

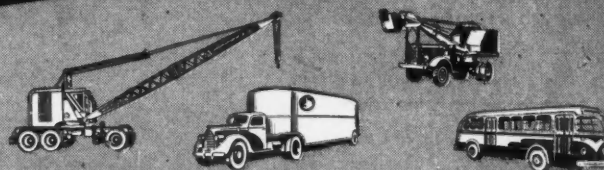
(Continued from page 42)

element type, there are other possible designs using two or more driven members. Often, as in the so-called two-stage fluid coupling, these driven members are interconnected to one or more of the gear trains in the transmission used. In the arrangement shown in Fig. 3, torque is transmitted from driven member A to the input gear in the underdrive gear train, the reaction of which is taken through an overrunning clutch C. Driven member B rotates with the output shaft. The speed relationship of these two driven members, below the so-called transition point, is established by the ratios of the gears in the train. At stall, the fluid circulates mainly between the impeller and intermediate runner A. The underdrive overall ratio is then substantially the ratio of the gears in the train. As car speed increases, however, more fluid circulates into runner B, and the overall numerical ratio diminishes by virtue of this hydraulic transition, as a higher percentage of torque is delivered directly to the underdrive output shaft through runner B. The numerical ratio continues to decrease with increasing car speed until the transition point, when the speed of driven member A equals the speed of the impeller, and ceases to transmit torque. At this car speed, the overrunning clutch starts to free wheel, and the drive is entirely through secondary runner B with a ratio of 1 to 1. Provision is usually made to lock the two runners together for higher efficiency in direct drive. The overall efficiency of a unit of this type is often lower than that of a two-element unit of comparable diameter.



# 9 GOOD REASONS

for using **VICKERS** Hydraulic POWER STEERING



**1 FINGER-TIP STEERING** Finger pressure steers the heaviest vehicle equipped with Vickers Hydraulic Steering. Short, quick, effortless turns ease the job of parking, backing, loading and maneuvering in city traffic. On the open road there is no lag or road wander.

**2 HEAVIER FRONT WHEEL LOADING** Many steering difficulties resulting from heavy front wheel loading are overcome by Vickers Hydraulic Power Steering. It provides light, easy steering with heaviest front wheel loading.

**3 LOWER STEERING RATIOS** Present high steering ratios can be lowered substantially with Vickers Hydraulic Power Steering.

**4 LESS DRIVER FATIGUE** The Vickers Hydraulic Power Steering Unit takes all the steering strain—the driver has none. Anxiety about unsafe tires and hazardous road conditions is relieved.

**5 LIGHTER CONSTRUCTION** An over-all weight reduction can be made in the construction of steering gears, housings and columns since all stress and shock are borne by the booster unit and vehicle frame.

**6 GREATER SAFETY** Blowouts, soft shoulders, ruts, cross winds, road obstructions or sudden stops—none affect steering. In event of engine failure or damage to the hydraulic system, steering automatically reverts to direct mechanical action.

**7 SHOCKLESS** On the road or off the road, the driver feels no road shock or wheel fight.

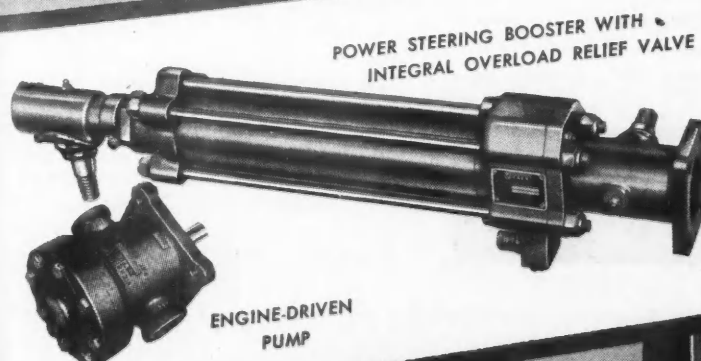
**8 LOWER COST** Simplified installation and lowered manufacturing costs due to increased production make the price per unit lower now than ever before.

**9 ADAPTABLE** Only minor alterations needed to apply Vickers Hydraulic Power Steering to new or existing vehicle designs.

Vickers Hydraulic Power Steering has been in successful use for more than 16 years. The redesigned unit with integral relief valve has had more than a year of testing on heavy buses and trucks under most severe operating conditions.

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC  
EQUIPMENT SINCE 1921

## Automatic Transmission Control Systems

(Continued from page 40)

Besides the shifting valves the control body contains a compensator valve, H, whose function it is to modify the initial oil pressure admitted to the friction elements during a shift. When an upshift is made at full throttle it is advisable to get the oil pressure acting on the clutch immediately just as high as possible—just short of a "bump

feel." This valve should be just sufficient to hold full torque on the element, but no more than that. A gradual pressure rise to a higher value should then follow to bring the engine speed down to its new value corresponding to the next higher gear in the transmission. This is, of course, accomplished through a slipping clutch action, and in order to safeguard the friction elements against excessively long slip time as well as prevent a loss of performance during the interval when the new element is engaging and the old element disengaging, it is important

that this exchange of friction elements is properly graduated to the prevailing drive torque in the transmission. If done too fast, there is a jerk in the shift. If done too slowly, there is a feeling of drag during the shift. The speed of this shift depends on the initial oil pressure admitted to the elements, the rate of rise above the initial pressure being determined by the springs of the shift accumulator and therefore constant. The final pressure acting on the clutches is always 80 psi—the full line pressure. At light throttle the shift is completed and the engine speed brought down to its new value before this final pressure has had time to develop in the clutch. At full throttle the shift is completed at about the time the final pressure is reached in the clutch. The final pressure produces a clutch holding torque approximately 30 per cent in excess of the maximum engine torque on the clutch.

The shift transition gets a valuable natural help out of the characteristics of a full wrap brake band. When in lower gear, the planetary unit is in reduction and the brake band is applied in its energized direction to hold the reaction gear tending to turn backward. A fairly small energizing force will hold considerable torque on the member under these conditions. When the clutch is applied, its application pressure is designed to reach a sufficiently high value to hold the drive almost immediately if the band were released at the same instant. The band is not fully released at this time, however. The initial clutch pressure acting on the releasing side of the band application piston is not sufficient, as yet, to completely release the band. As the clutch pressure rises above the initial pressure displacing the spring loaded accumulator piston, it reaches a value high enough to start bringing the engine speed down. The moment that this takes place, the reaction member held by the band must start turning in forward direction. The small amount of remaining band energizing force is almost negligible as a holding force when the rotation is started in non-energized direction, and as the clutch pressure rises further, the band is quickly released altogether. An interesting feature is that, since the self-energizing characteristics of the band are powerful in one direction and weak in the other, considerable discrepancies in the values will not affect the performance. This is particularly true if a double wrap band is used as in the front unit of the Hydra-Matic. There the difference in the holding power in the two directions is four times more pronounced than with the single wrap band. The rear unit band has to have reasonable holding power in non-energized direction as it is called upon to perform the manual downshift from high range to low range if a driver wants to use his engine as a brake on descending steep hills.

# VIBRATION can Never Loosen

## PALNUT

### Double Locking Action



The PALNUT is a single thread, spring tempered steel locknut. When tightened, its arched slotted jaws grip the bolt like a chuck (B-B), while spring tension is exerted upward on the bolt thread and downward on the regular nut (A-A), securely locking both.



### Absolute Security — Speedy Assembly — Low Cost

With a regular nut carrying the load and a Double-locking "Palnut" to keep it tight—you have a powerful fastening team that is unaffected by vibration, heat or oil. You've got a speedy team, too, because both the regular nut and "Palnut" spin on the bolt freely and install quickly with power tools.

Double-locking "Palnuts" are extremely low in cost, may be re-used and are interchangeable with other locking devices. "Palnuts" are being

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June 15, 1947

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# Air Briefs

(Continued from page 56)

## Explanation Simple

There are a number of obvious reasons for the crisis in the industry.

Throughout its life about 60 to 75 per cent of its business has been mili-

tary procurement but this has shrunk to only 1330 planes last year and will probably sink lower next fiscal year. The bulk of the remaining 25 to 40 per cent has been commercial transports, but production last year and this year will satiate the airlines for up to five years. In the meantime, tremendous development costs cannot be written off against production but simply must be absorbed and these run as high as \$3 million for a single aircraft design. Even the personal aircraft industry is flirting with the rocks with the heavy pendulum of postwar buying beginning its backward swing.

## Solution Painful

As unpopular as Government spending is at the present time, the only salvation for the industry is a pre-terminated plan of annual military procurement for at least five years. Although such a level might be too low for military requirements, nevertheless it would enable the industry to plan intelligently and perhaps reorganize into a smaller number of companies with specialized products. The aircraft Industries Association's President Oliver P. Echols proposes a modern Morrow Board, which would examine and report the current situation to the Congress. He banks on this plan because of the remarkable effectiveness of the 1925 board which sparkplugged the Army, Navy and Air Commerce Acts of the following year, all three of which put the United States in the air power business.

## Two To Four

With the denouement of the postwar lightplane rush near at hand, personal aircraft manufacturers are quietly converting their production from the ubiquitous 2-place models to 4-place designs. The "family" plane is frequently the next step in the flying career of a student-pilot-plane owner but 4-place models have been just out of reach of the average pocketbook with the North American Navion, Republic Seabee and Bellanca Cruisair well into the \$6000 class. These, as well as most 4-placers, have been "big" planes scaled down in the design approach. Most lightplane builders are now using the "little" plane scaled up approach with their eye on the \$4-5,000 price market. Piper's Skysean, which has been flying experimentally for a year, will go into production in early 1948. Cessna's new model 190 and 195 is a slightly enlarged version of its famous 2-place model and features the remarkable spring steel landing gear, none of which have been reported broken in service. Fairchild is readying an all-metal 4-place Model 47 for early Spring, 1948 production. Luscombe's 4-placer will be ready for flight tests shortly. Of considerable interest is the new Erco coupe four-place model with the famous two-control, spinproof feature. It is similar to the tricycle-gear, twin-tail Erco coupe now nearly out of production. Fred Weick, Erco Chief Engineer, has overcome the inherent difficulty with the two-control feature in large-size aircraft—high landing speed because flaps cannot be used—by the design of special flaps which minimize pitching moments during their use. Grumman is nearing announcement of its 4-place private plane. The future of the Seabee and its companion landplane "Bee" series, is uncertain, at the moment, following the resignation of Alfred Mar- chev as Republic board chairman.

(Turn to page 85, please)



Many forging designs in steel, aluminum and magnesium have been originated by Wyman-Gordon. Typical of the many intricate forgings is this four-way spider. . . . Every Wyman-Gordon forging is under strict, constant control by laboratories that through the years have contributed much to investigation and research of new forging techniques and of new alloys of steel and the non-ferrous light metals.

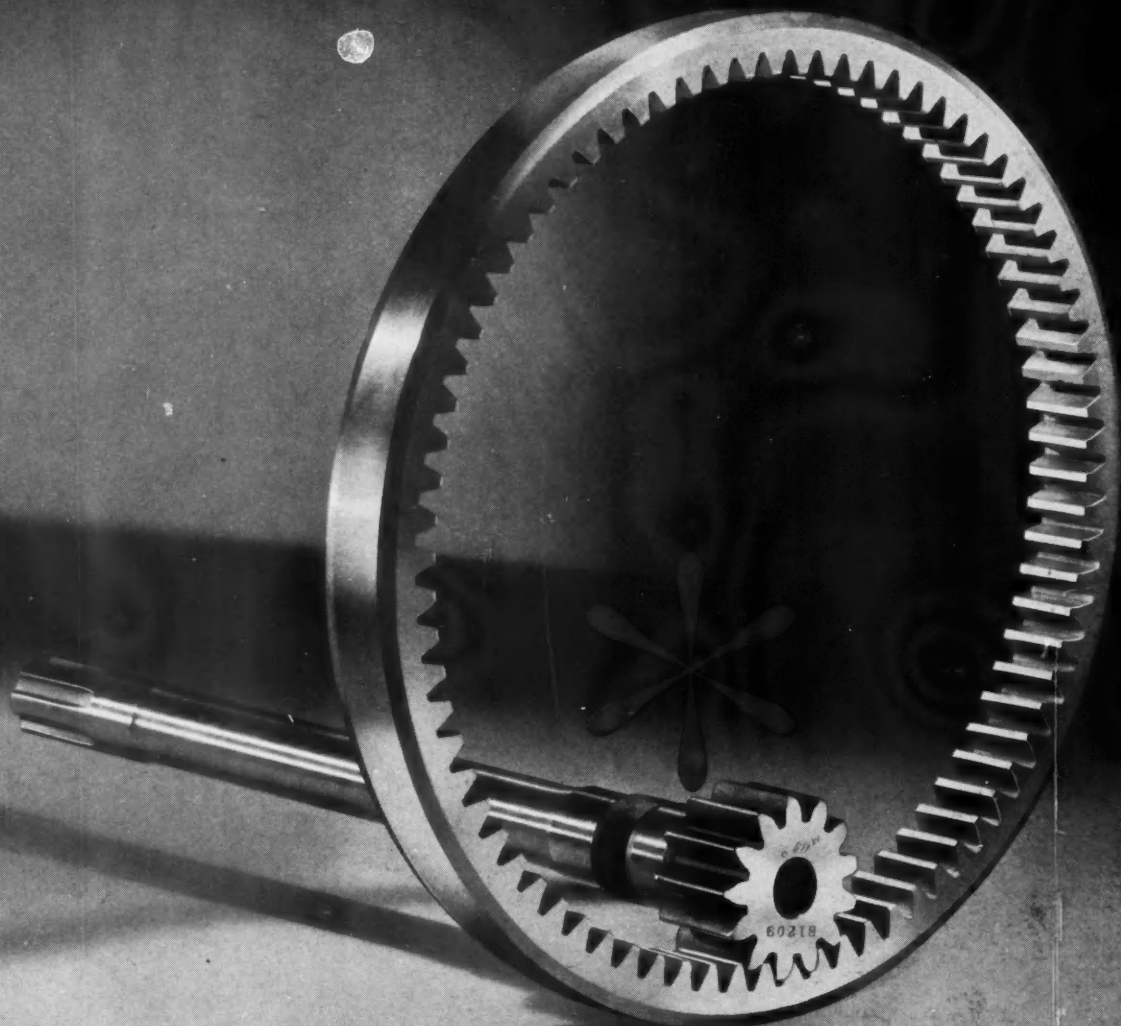
*Standard of the Industry for Sixty Years*

# WYMAN-GORDON

Forgings of Aluminum, Magnesium, Steel  
WORCESTER, MASSACHUSETTS, U. S. A.

HARVEY, ILLINOIS

DETROIT, MICHIGAN



## \*Reduction: 6 to 1...Maintenance: next to nothing

**THESE GEARS** are made to be *forgotten*—forgotten by the buyer who puts them in his products, and by the ultimate user. The photograph shows some of the clean, bright sparkle of *rightness* in these gears—but it would take a thousand pictures to tell the full story of a set of “Double Diamonds.”

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*standards—in quantity, and on schedule.*

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**Nickel**  
**Inconel\***

**"TASK METALS" FOR INDUSTRY**



# Air Briefs

(Continued from page 82)

## Noiseless Lightplane

The noiseless lightplane, discussed in these columns for several months, is now a reality. Last month at the NACA Langley Laboratory, an airplane was flown before 200 engineers and executives which could not be heard from an altitude of 300 ft! Thus, begins a new era in aviation with the removal of the major objection to the close-in airpark and lightplane flying around residential areas. The plane was a standard Army L-5 liaison-type fitted with a special NACA five-bladed fan-type propeller. A standard L-5 running at 2500 rpm came over the field with its habitual noise followed shortly by the NACA L-5 running at only 1000 rpm. Its noise was a quiet "whish" similar to that of a glider, made by the airflow over the wing and fuselage. The noise of the plane was reduced 90 per cent over the standard design. The personal aircraft industry now has the means and the example to eradicate this primary objection to its product.

## Sonic Barrier Threatened

The AAF has granted approval to Chalmers "Slick" Goodlin and Bell Aircraft to make an "all-out" attempt to fly faster than the speed of sound (660 mph at 30,000 ft) in one of the two Bell XS-1 rocket-powered research airplanes now flying. This attempt, plus a simultaneous attempt to reach 100,000 ft, a new world's altitude record in any conveyance, has been scheduled over the past three weeks with weather and mechanical difficulties the only delaying factors. Instrumentation will be carried on the Goodlin flight to obtain data on the performance of a piloted airplane flying faster than man has ever flown before.

## Aircraft Light Conditioning

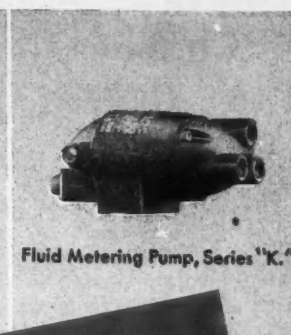
The Vickers Viking aircraft of the "King's Flight," a personal group of King George VI, are equipped with special "light conditioning" comprising polaroid window panes that permit delicate adjustment of the intensity of light admitted to the cabin from the outside sky, thereby controlling glare and eliminating the necessity for curtains. The inner pane of glass can be rotated from clear to complete darkness with an infinite range of varying intensity.



Dual Power Pack with  
Emergency Hand Pump, 17571.



Solenoid-Operated 4-Way  
Selector Valve, 14517.

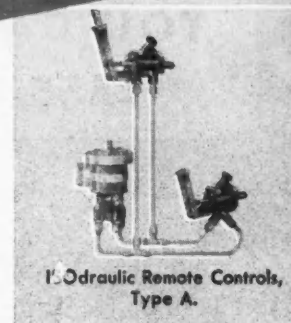


Fluid Metering Pump, Series "K."

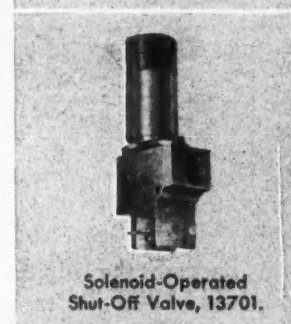
## A Complete Line of Hydraulic Equipment for Aircraft Applications

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Dual Connection, 15518.



We invite you to submit your hydraulic equipment problems to our engineering staff. General catalog is available upon letterhead request. Please address inquiries to 10747 Van Owen Street, Burbank, California.

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# Clutches for Automatic Transmissions

(Continued from page 41)

shaft, it is desirable to place all the clutches within the main transmission case. Usually this requires that the clutches be kept small in diameter so that there won't be too much interference between the top side of the transmission case and the floor line of the car. A combination of small-diameter multiple-disc clutches and bands, together

with free-wheeling or over-running clutches is the usual solution of this problem.

Table II shows friction factors of several materials as determined experimentally. While cork has a relatively high friction factor, it is much more easily destroyed by overheating than some of the available metal and asbes-

tos base facings. On the other hand, the latter materials being of a denser nature do not yield as much under load and may therefore require cushion supporting members to insure smooth action.

In design work it is important to remember that the coefficient of friction of any material is not a fixed factor. Variations as high as 50 per cent are not unusual. The primary cause of friction change in a dry clutch is heat. Wet clutches usually have a narrower operating temperature range with which to contend, but their torque capacity is greatly influenced by the amount of lubricant on the friction surfaces.

To avoid excessive drag, the discs should not be immersed in oil but should be lubricated by jets or spray. It is important that the oil escape freely at the outer diameter of the discs and openings should be provided for this purpose.

## HERE'S HOW YOU CAN HAVE LESS WHIP



## MECHANICS Roller Bearing UNIVERSAL JOINTS

Because the slip-on-the-transmission-shaft feature of this **MECHANICS Roller Bearing UNIVERSAL JOINT** permits using a solid connection between the joints, whip and lost motion are reduced to a minimum. Let our engineers show you how this and other **MECHANICS** advantages will benefit your new models.



**MECHANICS UNIVERSAL JOINT DIVISION**

*Borg-Warner*

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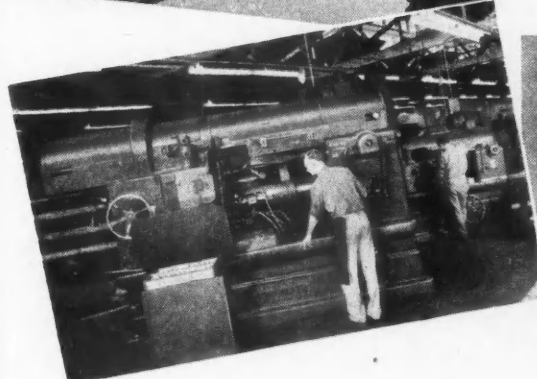
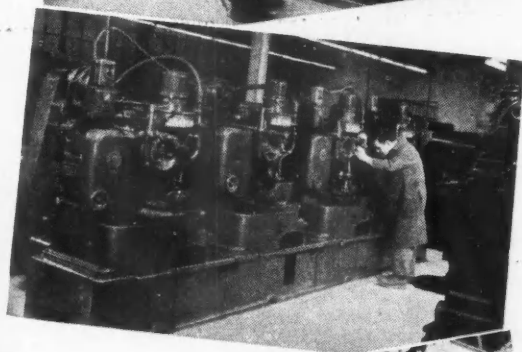
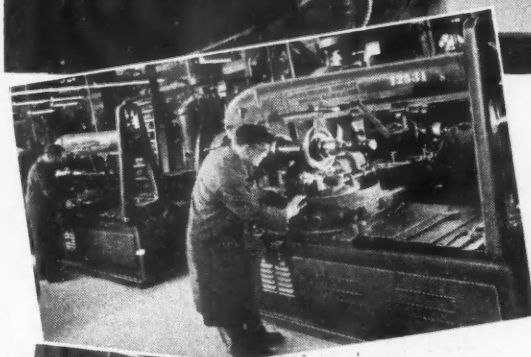
## CALENDAR

### Conventions and Meetings

- Amer. Soc. of Mechanical Engineers—Semi-Annual Mtg., Chicago...June 16-19
- Amer. Soc. of Testing Materials—Annual Mtg., Atlantic City...June 16-20
- Amer. Soc. of Mechanical Engineers—Applied Mechanics Div., Schenectady...June 23-25
- American Electroplating Society, Detroit...June 23-27
- Institute of the Aeronautical Sciences, Annual Summer Mtg., Los Angeles, Aug. 7-8
- Soc. of Automotive Engineers—West Coast Transportation & Maintenance Mtg., Los Angeles...Aug. 21-23
- Natl. Air Races, Cleveland...Aug. 30-Sept. 1
- Amer. Soc. of Mechanical Engineers—Fall Mtg., Salt Lake City...Sept. 1-4
- Amer. Soc. of Mechanical Engineers—Ind. Instrument & Regulators Div., Chicago...Sept. 8-9
- Instrument Society of America Conference, Chicago...Sept. 8-12
- Society of Automotive Engineers—Tractor Mtg., Milwaukee...Sept. 17-18
- Natl. Machine Tool Builders Assoc. Machine Tool Show, Chicago, Sept. 17-26
- Soc. Automotive Engineers, Aeronautic Mtg., Los Angeles...Oct. 2-4
- Amer. Soc. of Mechanical Engineers, Petroleum Mech. Eng. Conf., Houston, Tex. ....Oct. 6-8
- Natl. Conference of Industrial Hydraulics, Chicago...Oct. 16-17
- Amer. Soc. for Metals, Annual Nat'l Metal Congress & Exposition, Chicago...Oct. 18-24
- Soc. of Automotive Engineers, Production, Cleveland...Oct. 20-21
- Amer. Soc. Tool Engineers—Semi-Annual Mtg., Boston...Oct. 30-Nov. 1
- Natl. Aircraft Show, Chicago...Nov. 1-9
- Amer. Society of Body Engineers, Annual Tech. Convention, Detroit, Nov. 5-7
- Society of Automotive Engineers, Fuels & Lubricants Mtg., Tulsa...Nov. 6-7
- Society of Automotive Engineers—Air Transport Mtg., Kansas City...Dec. 1-3
- Amer. Soc. of Mechanical Engineers, Annual Mtg., Atlantic City...Dec. 1-5
- Automotive Service Industries Show, Chicago...Dec. 8-13
- Soc. of Automotive Engineers Annual Mtg., Detroit...Jan. 12-16

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by Ultra Modern Techniques...



What are your requirements in gears? Spur, helical, worm, bevel? You are probably familiar with Foote Bros. as a source for giant gears up to twenty feet in diameter, used in cement mills and sugar mill machinery. You doubtless know of the extreme precision gears this company produces for aircraft engines and other high speed applications. Foote Bros. also manufactures high quality industrial gears for practically every purpose. A few of the many applications for these gears include gas and diesel engines, tractor transmissions, mining and construction machinery and machine tools.

In the two large plants of Foote Bros. you will find the latest in shaving, lapping and tooth grinding equipment to hob and Fellows shape any type of gear. Here also is a modern heat treating department, including physical testing and metallographic laboratories, to provide the absolute control essential to meeting exacting hardness specifications.

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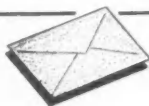
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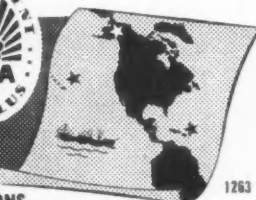
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## Business in Brief

*Written by the Guaranty Trust Co.,  
New York, Exclusively for AUTO-  
MOTIVE and AVIATION INDUSTRIES*

Moderate advances in general business activity are indicated. The *New York Times* index for the week ended May 24 stands at 146.4, as against 145.4 for the preceding week and 111.3 a year ago.

Sales of department stores during the week ended May 24, as reported by the Federal Reserve Board, equaled 277 per cent of the 1935-39 average, as compared with 273 per cent in the week before. Sales were 13 per cent above the corresponding distribution a year earlier, as against a preceding excess of 12 per cent. The total in 1947 so far reported is 11 per cent greater than the comparable sum in 1946.

Electric power production increased slightly in the week ended May 24. The output was 18.3 per cent above the corresponding amount in 1946, as compared with a like advance of 17.2 per cent shown for the preceding week.

Railway freight loadings during the same period totaled 890,605 cars, 0.3 per cent more than the figure for the week before and 55.3 per cent above the corresponding number recorded last year.

Crude oil production in the week ended May 24 averaged 5,024,850 barrels daily, 16,800 barrels more than the preceding average and 265,750 barrels above the comparable output in 1946.

Production of bituminous coal and lignite during the week ended May 24 is estimated at 12,820,000 net tons, 1.2 per cent less than the output in the week before. The total production in 1947 so far reported is 38 per cent above the corresponding quantity in 1946.

Civil engineering construction volume reported for the week ended May 29, according to *Engineering News-Record*, is \$72,226,000, or 36 per cent less than the preceding weekly figure but 0.5 per cent above the comparable sum in 1946. The total recorded for twenty-two weeks of this year is 4 per cent more than the corresponding amount in 1946. The increase in public construction is 16 per cent, but private construction is 3 per cent below that a year ago.

The wholesale price index of the Bureau of Labor Statistics for the week ended May 24 is 146.9 per cent of the 1926 average, as compared with 147.0 for the preceding week and 110.7 a year ago.

Member bank reserve balances decreased \$237,000,000 during the week ended May 28. Underlying changes thus reflected include a reduction of \$52,000,000 in Reserve bank credit and an increase of \$212,000,000 in Treasury deposits with Federal Reserve banks, accompanied by an advance of \$95,000,000 in money in circulation.

Total loans and investments of reporting member banks declined \$60,000,000 during the week ended May 21. A decrease of \$97,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, \$10,762,000,000, shows a net increase of \$3,295,000,000 in twelve months.

# Truck Bodies with Bigger Pay Load Fabricated by Arc Welding

BY DAVID B. LEVITCH, PRESIDENT  
GENERAL BODY MANUFACTURING CO., KANSAS CITY, MO.

**I**N the manufacture of truck bodies, both our own standard models and special jobs, we have found that 100% welded steel fabrication gives us the fastest production and lowest cost, permits more designing freedom and gives the customer bigger pay loads.

Our method of production is to build each body in sections which can be assembled and welded in jigs. This use of jigs simplifies assembly, insures accurate and tight fitup, and permits positioning for maximum use of down-hand welding. These sub-assemblies are then welded into a complete body, usually by two welders and two helpers working on each body.

One of our standard models is the beverage delivery body shown in Fig. 1. It is 12 feet long, 7 feet wide and 6 feet high, holds 164 cases. The framework consists of 2" x 1/4" angles, and the sheets are 16-gauge. The fenders and rear-end advertising compartment (see Fig. 2) are formed and welded. All welds are either lap or butt joints made in one pass with 1/8" "Fleetweld 37." This electrode is preferred because it has a minimum of slag interference in all-positions of this material.

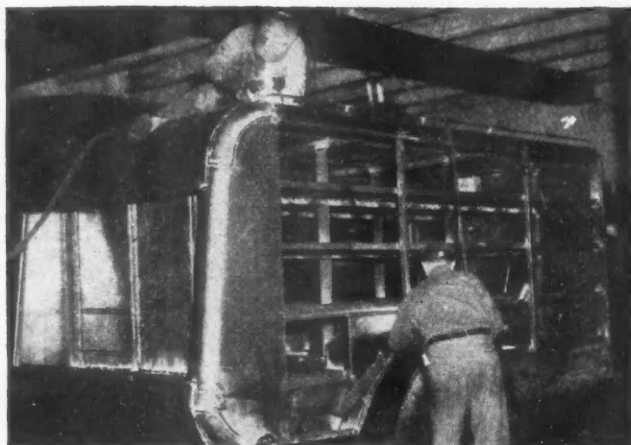


Fig. 1. Finish-welding a beverage delivery body.

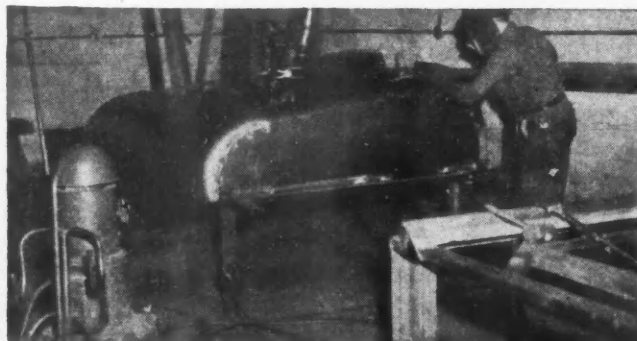


Fig. 2. Advertising compartment for beverage body. Formed sheets are assembled and tack-welded on the table-type jig, then continuous welded with "Fleetweld 37."

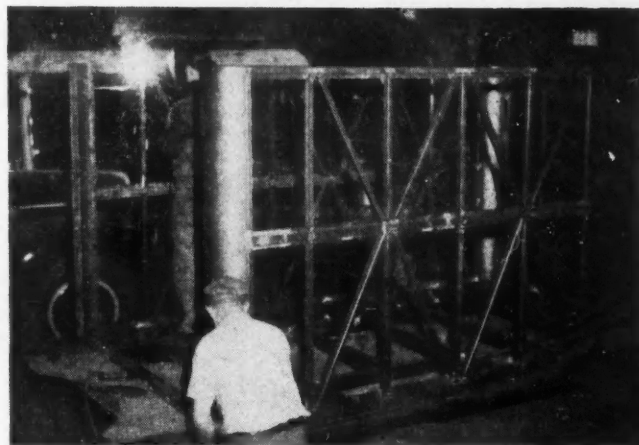


Fig. 3. Framework of freight body.

Another type is the freight body, framework of which is shown being welded in Fig. 3. Note that welders work on opposite sides to equalize expansion-contraction forces. This framework is fabricated of 16-gauge channels, 1 1/2" x 3/4", and 4" x 3/8" Z-bars. The horizontal center rail of the sides is fabricated of 16-gauge sheet, sheared to size and shaped in a 325-ton hydraulic press to form channels which are welded into box sections. All welding consists of one-pass butt joints made with 1/8" size "Fleetweld 37."

Typical of our body tops is the top of the van panel body (Fig. 4). First the 22-gauge corrugated sheet is tack-welded to the 16-gauge formed sides, then continuous-welded with single pass fillets using 3/32" "Fleetweld 7" because of the exceptional thinness of the material.

The two welders have two helpers who assemble the parts in the table-like jig.

In developing our body production procedures, we have found helpful the advice of the local Lincoln Electric engineer. Manufacturers who desire such consultation may obtain it by writing THE LINCOLN ELECTRIC COMPANY, Dept. 433, Cleveland 1, Ohio.



Fig. 4. Welding top of van panel body.

(Continued from page 47)

rapidly dissipates the heat, where and when it is generated.

No mechanical adjustment of the Warner Electric brake or clutch is needed. A very light spring pressure upon the armature causes it to follow up any wear on the two friction surfaces, therefore, no attention is necessary for the life of the unit.

The magnet of the clutch receives its

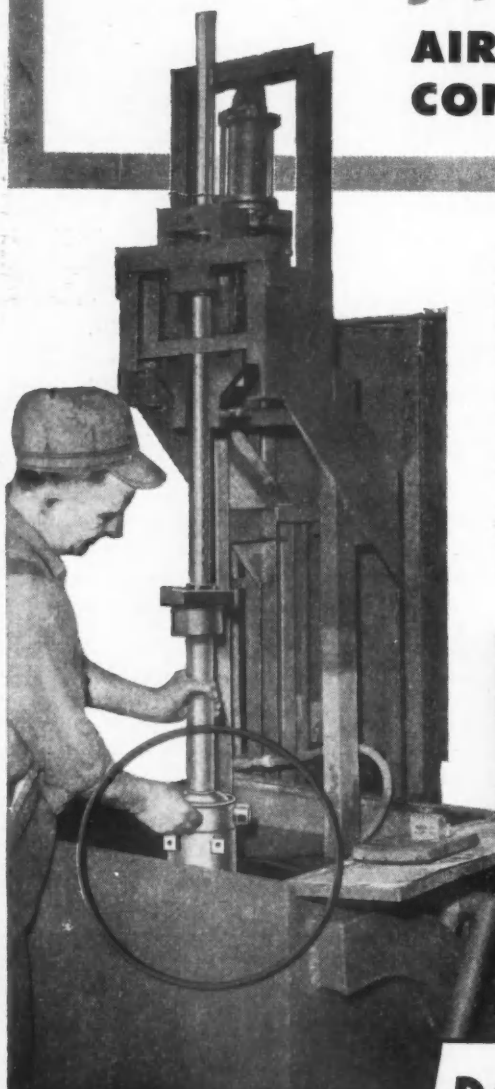
current through a collector ring, brush and brushholder assembly. The collector rings are of the radial type and are carried on the magnet mounting hub by means of a fibre insulator ring. The current to the magnet is brought to the collector rings by four brushes carried in a brushholder assembly, bracket mounted to a stationary position of the machine. As static torque ratings are

two to three times that of running torques, there is no possibility of the clutch slipping after the magnet and armature have locked in.

The Warner Electric brake is especially suited for applications where the rate of braking and the desired braking effect must be readily adjustable or under the control of the operator. The amount of magnetic pull between magnet and armature varies with the current in the magnet coil. This current is readily adjusted by means of an external rheostat. This control can be co-ordinated with other operations and arranged to perform in sequence as a definite phase of an operating cycle.

The Warner "ICB Unit" requires only 25-35 watts of direct current for full application. As operation is dependent upon the power supply — it should not be used where power failure would result in damage or danger to machine or operator or violate safety rules. A source of auxiliary or emergency power, however, will serve to guarantee operation. Direct current must be used for energizing the magnet. This can be obtained through a battery, other source of direct current, or through a rectifier from an alternating current power source. Both clutches and brakes are available for operation on either six or 90 volts d-c, the latter being the output of the rectifier used with 110 volts a-c input.

## Proving AIR-TIGHT CONSTRUCTION



Making an air cleaner *air tight* is essential. A leak would allow dusty air to by-pass the oil washing process and enter the engine. To insure air-tight construction, Donaldson Air Cleaners are given this underwater pressure test. The air cleaner is mounted on a specially built machine, submerged in water, and air pressure is introduced at 15 pounds per square inch. Any leak can be detected instantly by tell-tale bubbles.

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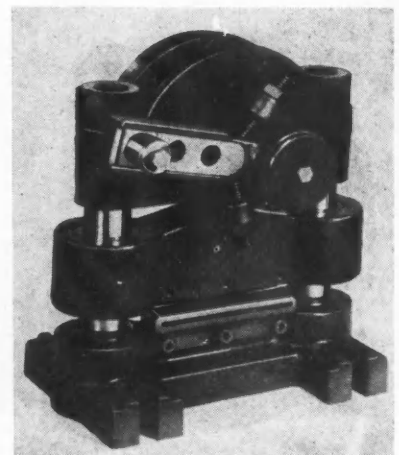
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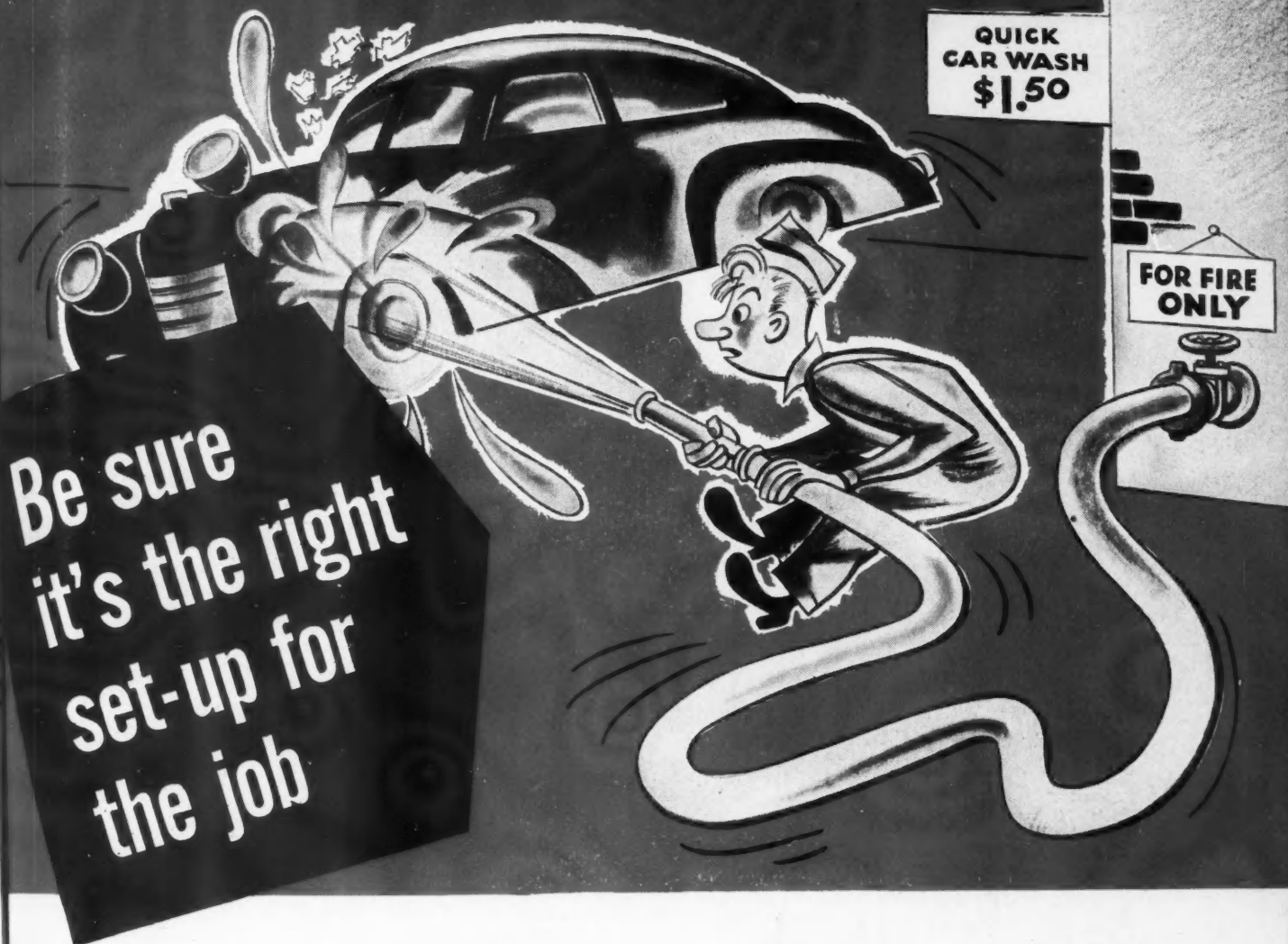
## B-60—Scrap Cutter



This ram-driven scrap cutter which can be used on almost any punch press is produced by Heller Machine & Mfg. Co., Inc., 7940 Tireman Ave., Detroit 4, Mich. This unit will cut all stock to 4 in. width and 3/32 in. thickness. Known as the Heller Model D-611 scrap cutter, this unit is unusually compact measuring only 6 1/2 in. wide by 9 1/4 in. deep by 10 in. high over all. It is mounted on the bolster plate of the press, is driven directly from the ram or die, and is adjustable for any length of ram stroke up to 6 in. The high-speed steel blades are readily removed for sharpening and are replaceable.

(Turn to page 94, please)





## WHEN IT'S A QUESTION OF PISTON RINGS

American Hammered can help you select the set-up that is just right for the equipment you are designing! Be sure to include American Hammered **POROUS CHROME\*** in your specifications! These amazing rings have already set spectacular mileage records... delivered peak performance mile after mile after mile! Now, they embody another new, exclusive American Hammered

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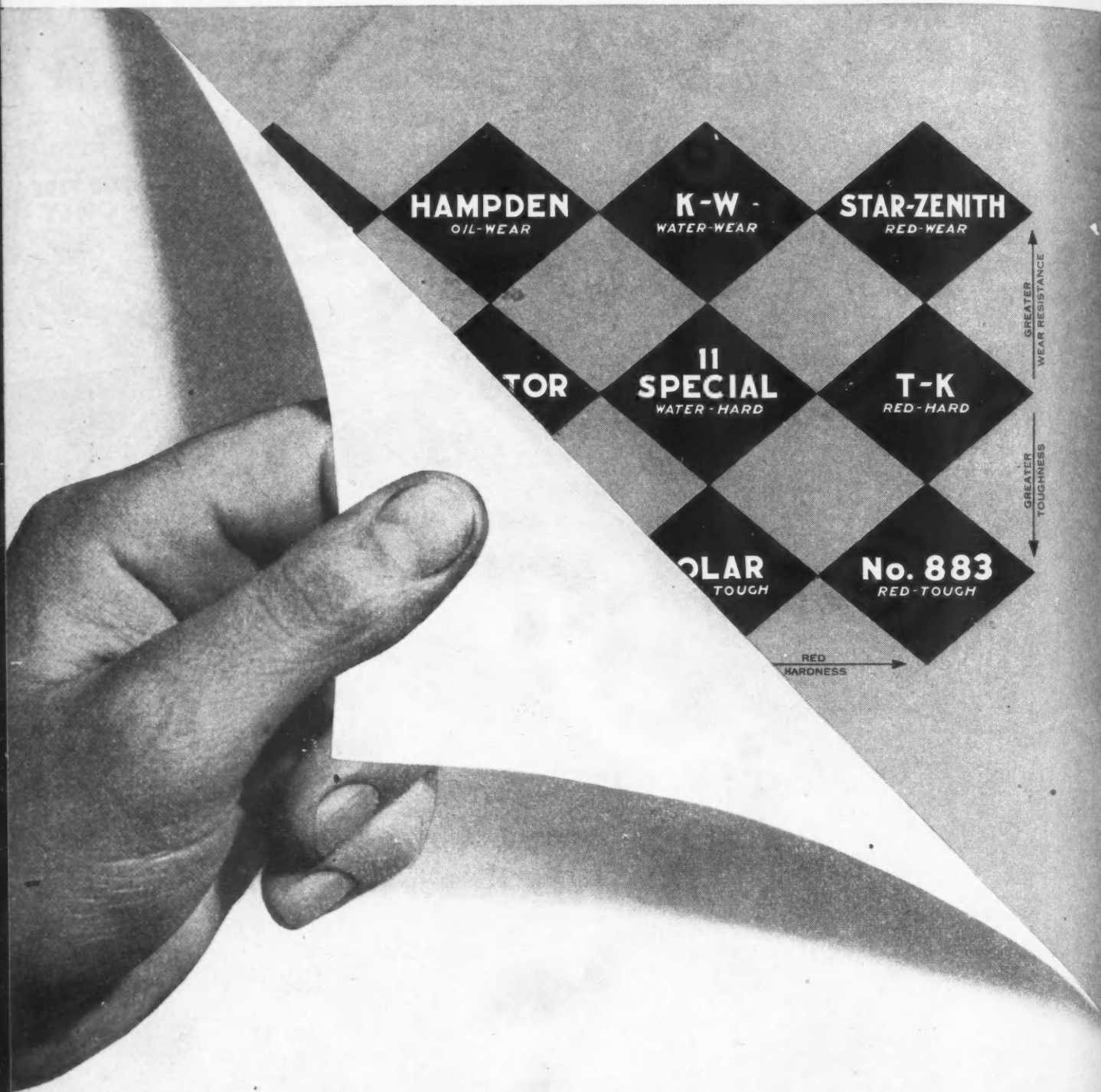
development—F-88 Hi-Strength castings, which give even greater wear resistance, higher impact strength, increased elasticity.

A combination of **POROUS CHROME** compression rings with one of the several types of American Hammered oil control rings will give you maximum piston ring efficiency and long life. Our engineers are prepared to assist you in selecting the set-up that is just right for *your* job. Koppers Company, Inc., Piston Ring Division, Box 626, Baltimore 3, Maryland.



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**H**ere is one way to modernize your tool room without spending a cent!

Since 1934, Carpenter customers have been getting the benefit of the Matched Set Method. Now a new Carpenter Matched Set has been developed to help you meet today's demands for higher performance and lower unit costs.

The new Carpenter Matched Set of 12 Tool Steels can solve practically any problem that comes up in your tool room. Selecting the right tool steel for top performance on each job is greatly simplified. By following this method you can know in advance what results to expect as you switch from one steel to another. And think of the savings in *reduced inventories alone*—because you need stock far fewer steels!

Find out now how the new Matched Set can help you modernize your tool room—reduce costs all along the line from tool making to finished output. Ask your Carpenter representative for the new Carpenter Matched Tool Steel Manual. Use its 189 pages of selection and heat treating data—and get all the benefits of the new Matched Set, now.



**FOR IMMEDIATE DELIVERY**

**Call Your Carpenter  
Warehouse or Distributor**

# NOW

## a new *Carpenter* Matched Set...

### TO HELP YOU SOLVE TODAY'S TOOLING PROBLEMS!

★ Higher Output!

★ Lower Unit Costs!

★ Simplified Tool Steel Selection

★ Safe, Accurate Heat Treatment

★ Reduced Tool Steel Inventories!



## B-61—Lightweight Hand-Operated Hoist

The Chisholm-Moore Hoist Corp., Tonawanda, N.Y., offers a new high-speed, hand-operated hoist that is said to be 96 per cent efficient. Known as the Cyclone Model M, the new high speed hoist is available in four standard capacities: ¼ ton, ½ ton, one ton and two tons. All models are equipped with "Herc-Alloy" steel chain.

Through the ingenious use of steel and aluminum alloys, the weight of the hoists has been reduced to a point where they are nearly 45 per cent lighter than standard hoists of com-

parable capacity, according to the manufacturer. This makes the hoist easier and safer to handle and install. Along with weight saving, strength and durability have been increased while all excess bulk has been eliminated.

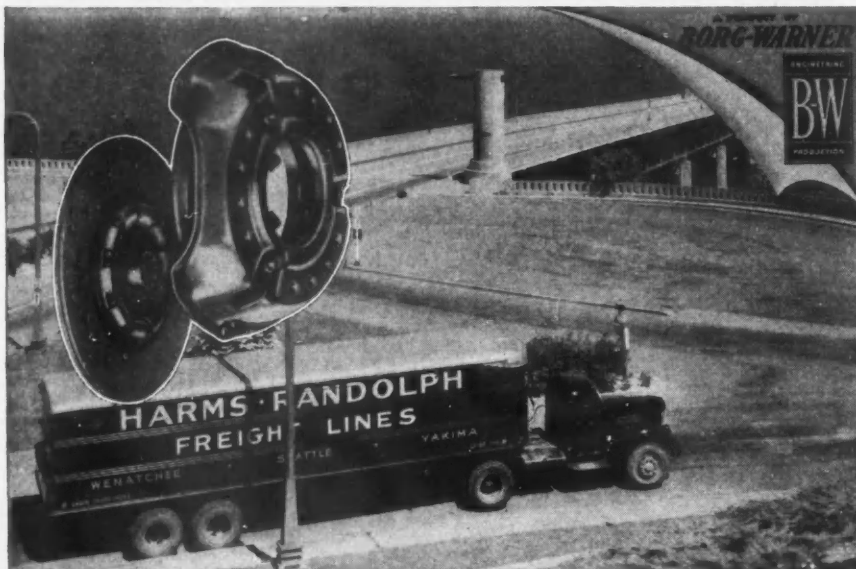
A reduction in the number of component parts is another feature of the hoist. All rotating parts are fitted with precision ball bearings that have double sealed-in lifetime lubrication.

Improvements have also been made in the lift wheel, load chain guide, gearing and load brake. Particular attention was given to reducing to a minimum the pull required by the operator to lower the load.



*Cyclone model M hoist*

# ROCKFORD



## SPRING — LOADED CLUTCHES

**LIGHT PEDAL PRESSURE**

**CUSHIONED ENGAGEMENT**

**VIBRATION DAMPENING**

**ACCURATE BALANCE**

**DIRT EXCLUSION**

**HEAT DISSIPATION**

**LIFETIME ADJUSTMENT**

\* The life of ROCKFORD Spring-Loaded CLUTCHES is lengthened by the design of their cover plates. This feature provides maximum ventilation for the clutch. The openings in the top and sides supply a flow of air that promotes cooling and the escape of dirt and dust from the clutch. This life-lengthening cover design is one of several ROCKFORD advantages.

\* **Send for This Handy Bulletin**

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.



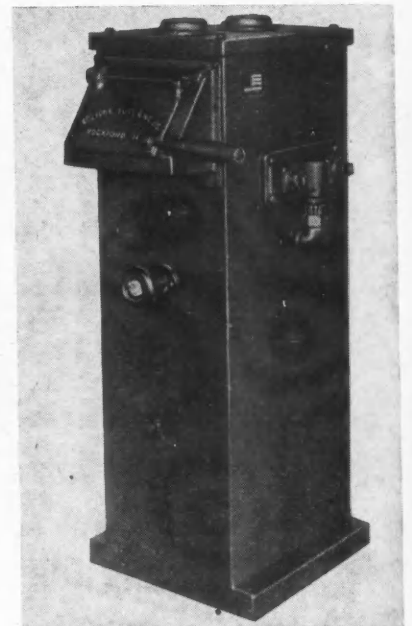
**ROCKFORD CLUTCH DIVISION**

**BORG-WARNER**

315 Catherine Street, Rockford, Illinois, U.S.A.

## B-62—Redesigned Shop Furnace

A completely redesigned shop furnace is now in production at Eclipse Fuel Engineering Co., 768 S. Main St., Rockford, Ill. This automatic shop fur-

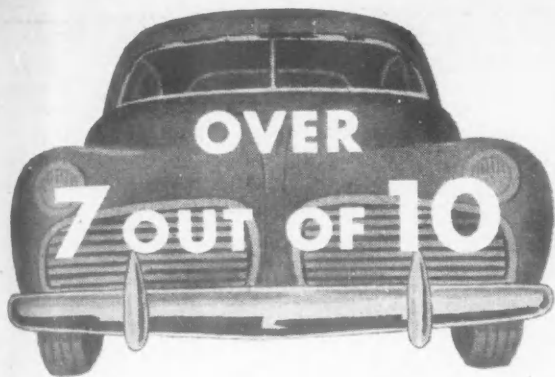


*Eclipse automatic shop furnace*

nace is now made of fabricated steel instead of castings.

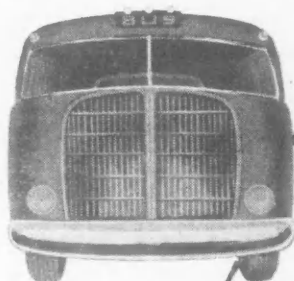
The unit is fully enclosed. A streamlined body completely houses all working parts, protecting them against dust and damage.

The arrangement of the working parts has also been streamlined. The McKee Eclipse centrifugal blower is driven by a direct-connected motor. A McKee proportional mixer automatically regulates the proportion of gas and air.



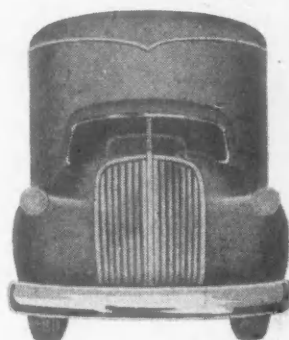
**Automotive Vehicles**

**Ever Built**



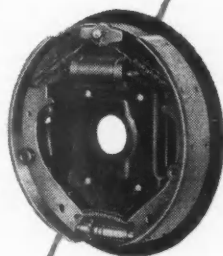
**have been**

**Better Because of**



***Bendix Experience***

That Bendix is the world's largest manufacturer of automotive brakes is common knowledge in the trade. Bendix engineering experience over the years serves as concrete assurance of better things from Bendix in the future. Expect the best from Bendix—Brake Headquarters for the automotive industry.



Experience is the reservoir of precedent that holds many of the answers to problems of the future, and makes it possible to avoid errors of the past. The most promising plan can go astray in one tiny error that experience would have forestalled. And in the automotive field—where experience is the keystone of success—Bendix\* can point to thirty years' cooperation with a progressive industry.

\*REG. U. S. PAT. OFF

**BENDIX PRODUCTS DIVISION of**  
SOUTH BEND 20, IND.



WHEEL BRAKES

HYDROVAC\* POWER BRAKING

CENTERMOUNT PARKING BRAKE

B.K.\* VACUUM POWER RELAY VALVES

HYDRAULIC REMOTE CONTROLS

TRAILER VACUUM POWER BRAKES

UNIVERSAL JOINTS

HYDRAULIC POWER STEERING

***Bendix***  
**PRODUCTS**  
**DIVISION**

# General News

(Continued from page 23)

market. One producer has surveyed western lead mining areas and finds that at current high prices there is available almost unlimited ore supplies ready for treatment and distribution. The labor shortage is the limiting factor because of the seasonal labor migration from the mines to the fields. Recent high production levels are expected to be exceeded in

the fall when the labor supply is adequate, and some price weakness of lead may then be expected.

## Cadmium

The supply of cadmium is still well below the demand. Established buyers continue to get their supplies on an allocation basis. Cadmium continues to be priced at \$1.75 a pound by major producers.

## 5000 hp Jet by Menasco

An American turbo-jet engine producing a rated thrust up to 5000 lb

has been developed by the Menasco Mfg. Co. of Burbank, Cal., for the Army Air Forces. Designated as the XJ-37, the engine can be applied as a turbine with propeller or as a pure jet engine. An extremely small frontal area, facilitates installation in either wing or fuselage.

## Eaton's Pump Div. in Michigan

In a news item entitled "Eaton Reorganizes Michigan Divisions" which appeared in the May 15 issue of AUTOMOTIVE AND AVIATION INDUSTRIES, it was incorrectly stated that one of this well known company's new Michigan divisions would be a Bumper Div. This should have been Pump Div.

## AMA Reelects Mason

The Automobile Manufacturers Association recently reelected as president George W. Mason, president, Nash Kelvinator Corp., at the annual meeting. Paul G. Hoffman, Studebaker Corp., vice-president; Robert F. Black, White Motor Co., vice-president; Alfred Reeves, advisory vice-president; M. E. Coyle, General Motors Corp., secretary; George T. Christopher, Packard Motor Car Co., treasurer, and George Romney, managing director, were the other officers reelected.

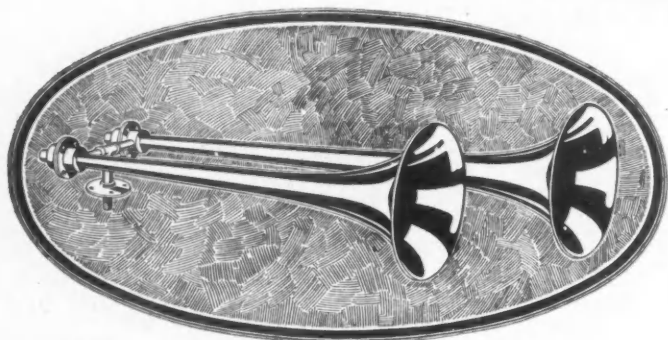
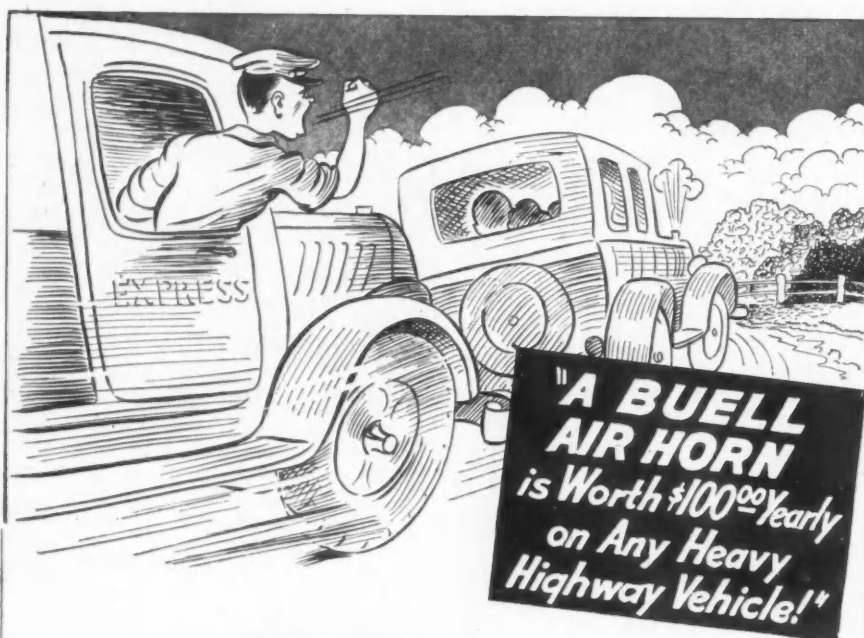
Members of the board of directors reelected were Mr. Black; Mr. Mason; B. E. Hutchinson, Chrysler Corp.; and C. E. Wilson, General Motors Corp.

## Metal Powder Men Meet

At the third annual spring meeting of the Metal Powder Association, held recently in New York City, H. E. Hall, president, stated that the production of iron powder in the U. S. was about 40 tons a day, an all-time high. Mr. Hall, speaking before nearly 500 of the metal powder industry's most prominent men, asked for better cooperation between metal powder fabricators and users as a basis for a five cents-per-lb iron powder.

Included among papers presented at the session was one on the uses and physical properties of stainless steel powder by John D. Dale, president of Charles Hardy, Inc. Stainless steel powder, Mr. Dale stated, is now being used in welding, and is about twice as fast as the usual rod. Other uses for this powder, he declared, were as a bearing material, in acid-resistant filters and as a cladding surface. Also, it has been found that the addition of stainless steel powder to monel improves the corrosive resistant properties of that alloy.

(Turn to page 98, please)



- Buell Air Horns are tops in warning signal efficiency.
- Installed as original equipment on many Trucks and Buses.
- They reduce maintenance costs by decreasing stops, starts and slowdowns.
- All records prove that they save tires, brakes, clutches and gears.
- Cut gas and oil consumption.

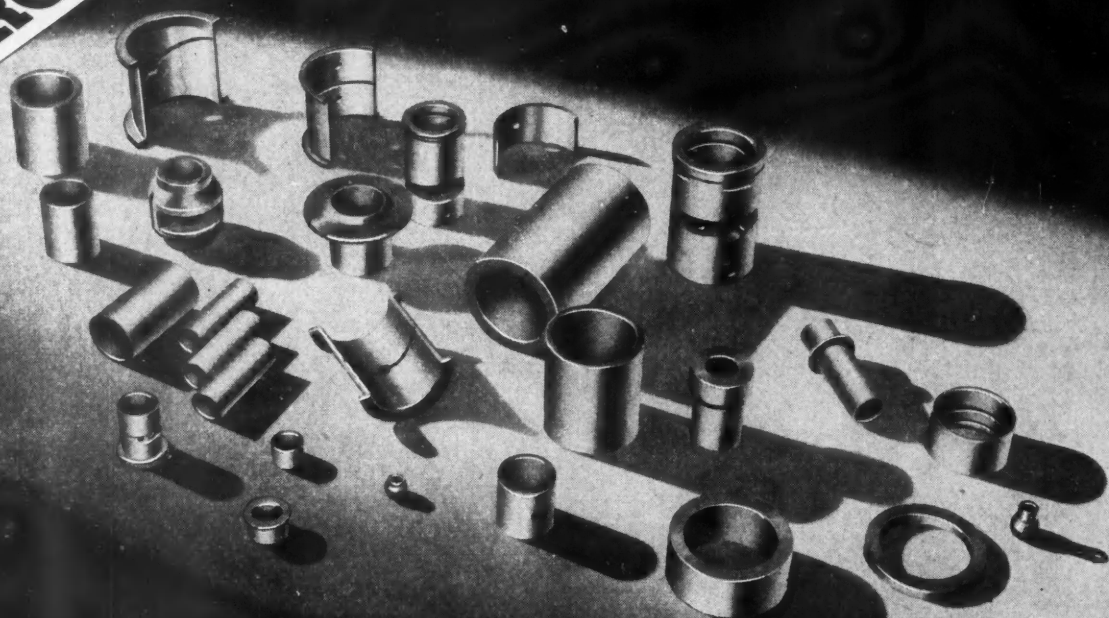
With a Buell the driver has greater security, maintaining a steady cruising speed. Slowing a 20 ton load from 50 MPH to 30 MPH means destroying a lot of energy thru brake lining and tires. It is replaced by burning more gasoline, increasing load on engine and tires again, to regain speed. This all costs money. We believe a Buell Air Horn is worth \$100.00 yearly on any heavy highway vehicle. Then remember a Buell will last more than 10 years. How would you rate a \$100.00 investment that earned \$100.00 yearly for 10 years. Ask the man who has a Buell.

**BUELL MANUFACTURING CO.**  
2975 Cottage Grove Ave., Chicago 16, Ill.



**JOHNSON  
BRONZE**

# SLEEVE TYPE BEARINGS



## *One or a Million Excellent Delivery*

### *Technical Data*

Sleeve Bearing Data Sheets  
containing a wealth of infor-  
mation for all users of Bear-  
ings. Write for your free copy.

is now possible on Johnson SLEEVE TYPE Bearings. It makes little difference which type you require . . . cast bronze . . . sheet metal or babbitt lined . . . we can deliver your order in days not months. Regardless of the size you need, we can easily meet your most exacting specifications. No order is too small to merit our close attention to detail . . . no order is too large to tax our facilities.

When you have a bearing problem we can help you find the correct solution. Simply call in your local Johnson Bronze representative. Permit him to study your applications . . . to determine the service required of the bearings. He will give you the right answers . . . supported by more than forty years exclusive bearing experience.

*The next time you need SLEEVE  
BEARINGS call Johnson Bronze FIRST!*

**JOHNSON**

**SLEEVE BEARING**

**625 S. MILL STREET**

*The  
MOST  
COMPLETE  
SLEEVE  
BEARING  
SERVICE  
in the  
WORLD*

**BRONZE**

**HEADQUARTERS**

**NEW CASTLE, PA.**

## General News

(Continued from page 96)

### Buick Buys Foundry— Convert to Machine Shop

Buick Div. of General Motors Corp. has purchased the former government aluminum foundry at Flint and will remodel it into a machine shop at a cost of \$1 million. On a 33 acre site and with 601,000 ft of floor space, the plant was purchased

for slightly more than \$2 million. Building alterations will cost \$442,000 with the balance of the \$1 million expenditure going for a new power system, lighting, cleaning, and painting.

### No Atom Power For Cars and Trucks

The so-called "atomic capsule" power unit for motor cars and trucks, visualized by some enthusiastic designers is not within the realm of practical possibility, according to

Bruce R. Prentice, General Electric Co., who recently addressed a meeting of the Engineering Society of Detroit on the "Industrial Application of Atomic Energy."

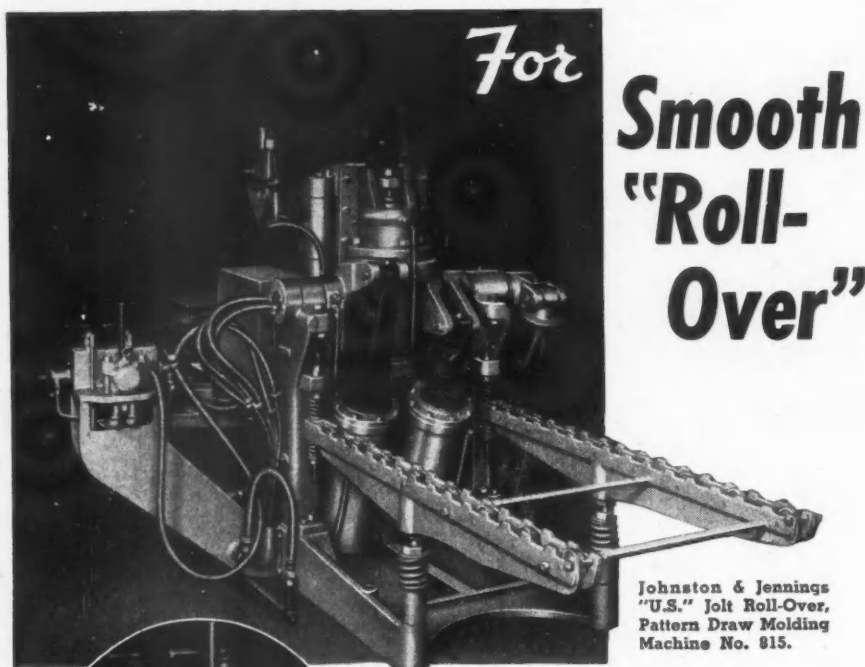
An authority on the subject, Mr. Prentice is staff assistant to H. A. Winne, GE vice-president, who will direct the \$20-million Knolls Atomic Power Laboratory at Schenectady. In describing the industrial potential of nuclear fission, the speaker listed a variety of knotty engineering problems requiring solution including shielding the power plant to prevent egress of radioactive particles; disposal of waste products; development of suitable liquids for abstracting heat from the power pile, and replenishment of radioactive material. It is possible, he said, that mercury may be employed as the pile cooling and heat absorbing medium.

### Ryan After Burner Adds Thrust

Recently developed by the Ryan Aeronautical Co. San Diego, for the U. S. Navy Bureau of Aeronautics is an after-burner thrust augmentor which is claimed to add more than one third to a jet-engine's normal propulsive thrust. Ryan states that this after burner, the first specifically designed for regular use in flight, will be valuable in breaking through the compressibility barrier as planes approach the speed of sound, and in giving added power for take-off and other occasions where extra thrust and speed are required. In basic conception the Ryan after burner is a ram-jet engine installed downstream from the turbine of a conventional jet engine. Additional fuel is sprayed into the tailpipe where its burning adds mass and velocity to the speeding gases of the jet stream. Starting is accomplished by ignition from a spark plug. Ryan states that fuel consumption of the after burner at low speeds is high compared to the jet engine, but at very high speeds, it is more economical than the turbo-jet.

### Plan to Price Tag Tucker Car at \$2000

Tucker Corp. plans to sell its new automobile for under \$2000 delivered, according to the latest information. Company officials have stated that the six-cylinder horizontally-opposed 150 hp engine will have no camshaft. A hydraulic mechanism mounted on the block will actuate and time the valves, utilizing engine oil pressure. One of the advantages cited for this system is that, in case of lack of oil in the engine, the mechanism will cease functioning and the engine will stop. (Turn to page 100, please)



Johnston & Jennings  
"U.S." Jolt Roll-Over,  
Pattern Draw Molding  
Machine No. 915.

### ... Johnston & Jennings Specifies **N O P A K** 5-Way Manifold Valves

"U.S." Jolt Roll-Over, Pattern-Draw Molding Machines are built for continuous, rugged service under arduous working conditions. Smooth, controlled sequence of cylinder action is required to actuate the heavy roll-over mechanism hundreds of times a day, with a minimum of wear, shock, and vibration.

NOPAK Valves are ideally suited to this purpose because the valve disc rotates at right angles to the stream flow. This basic NOPAK principle provides positive control through the complete cycle of valve operation...from slow, gradual, throttling action to immediate opening of full pipe area...without damaging shock or impact.

Specify NOPAK Valves for smooth, shockless control of air or hydraulic power, either in your plant equipment or machines you build for resale.

GALLAND-HENNING MFG. CO., 2774 S. 31st St., Milwaukee 7, Wis.

**N O P A K**  
**VALVES AND CYLINDERS**  
DESIGNED for AIR and HYDRAULIC SERVICE

A 5089-1/2 I

Above: Close-up view of NOPAK 1/2" 5-position Manifold Valve. This is essentially a 3-way valve for staggered actuation of 2 single-acting cylinders.

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TRIES





# OIL SEALS *Engineered* TO THE REQUIREMENTS OF YOUR NEW PRODUCT

In serving industry over a period of years, sealing problems of all types have been encountered and solved. The many installations cover a wide range of shaft speeds, lubricant pressures, operating temperatures and the presence of grit, moisture or corrosive agents. Each problem has contributed to broadening the range of application of "Perfect" Oil Seals.



Today, the product designer having any given set of operating conditions can choose a "Perfect" Oil Seal which has been proved satisfactory under similar conditions and on which authentic service records can be cited.

Regardless of how much experimenting you may find necessary with other phases of your new product design, there need be none concerning the sealing of shafts. Ask Chicago Rawhide Engineers for their recommendations.

## CHICAGO RAWHIDE MANUFACTURING COMPANY

1112 ELSTON AVENUE • CHICAGO 12, ILLINOIS

BRANCHES: CLEVELAND • NEW YORK • DETROIT • BOSTON • PITTSBURGH • PHILADELPHIA

SOLE AGENTS: The Quality Mechanical Supply Co., Inc. • Goods Exclusively and Promptly Shipped

# General News

(Continued from page 98)

Described in the Feb. 1, 1947 issue of AUTOMOTIVE AND AVIATION INDUSTRIES other features have not been changed. The hydraulic drive previously mentioned will consist of a special double fluid torque converter and a planetary gear train, which will have two generators and reverse. Two of these assemblies are required for each car, one on each end of the crankshaft.

Aluminum construction is used largely throughout the engine and power transmission elements and the car is said to weigh just a little over 2900 lb. Basic body panels will be purchased from outside companies and will be assembled and painted at the factory. The company states that it will use the new electrostatic painting system which is installed under lease by the manufacturer. Savings with this system are said to approximate 21 per cent under the conventional spray method. The car is not too radical in design but is considerably lower than con-

ventional cars, achieved partly by use of a 7.00-13 tire, the smallest used by any conventionally sized automobile today. According to present plans, Tucker will inaugurate a "package" service system in which various units or the entire engine can be quickly removed and exchanged for a new one. The company says the engine can be disconnected and slid out of the car in a few minutes. Tucker expects to collect \$12 million from sale of franchises by September. The dealer organization is expected to number about 1800 dealers who will work under distributors.



*For Both*

—IN ONE OPERATION

## Specify TRIAD EMULSIONS

Two operations in one! That's what many auto parts fabricators are doing to cut material costs and handling time.

In an eastern plant, for example, TRIAD 90 is being used to remove cutting oils, chips, and soluble oils from king pins and shackles, and at the same time to protect them from rust. Previously, because of the plant's location, severe rusting occurred as soon as seven hours after washing.

TRIAD 90 removes both soluble and insoluble soils. It is rinsable in water and does not attack metal. For full information on Detrex Emulsions, as well as the equipment in which they are used, write today.



**DETREX**

DETROIT 32, MICH.

*Corporation*

E-127

## Final Scorecard For Indianapolis Race

The final results of the Indianapolis 500 mile classic are shown below, with the exception of the first seven, detailed on page 17:

Driver	Car Name	Cause of Withdrawal
Marshall	Tattersfield Spl.	Flagged
Agabashian	Ross Page Spl.	Flagged
Dinsmore	Schoof Spl.	Flagged
Anderson	Kennedy Tank Spl.	Broken gas tank
Romceovich	Camco Spl.	
Wearne	Superior Industries Spl.	Spin
Andres	P. Tucker Ptnr. Spl.	Magneto trouble
Fowler	Don Lee Spl.	Broken rear axle
Chitwood	Peters Spl.	Broken starter
Nalon	Don Lee-Mercedes Spl.	Broken piston
Free	Bristow-McManus Spl.	Broken rod
Bettenhausen	Belanger Spl.	Broken timing gear
Snowberger	Federal Engineering Spl.	Oil pressure
Robson	Palmer Spl.	Universal joint
Bergere	Novi Gov. Mobil Spl.	Engine failure
Cantlon	Automobile Shippers Spl.	Crashed
Connor	Ed Walsh Spl.	Split gas tank
Miller	Preston Tucker Spl.	Magneto trouble
Banks	Federal Engineering Spl.	Oil supply exhausted
Hansen	Thorne Engineering Spl.	Disqualified
Russo	Wolf Spl.	Collision
Van Acker	P. Tucker Ptnr. Spl.	Collision
Fankhauser	Club Southern Spl.	Broken rear axle

## Pratt & Whitney Offers New 1650 hp Twin Wasp

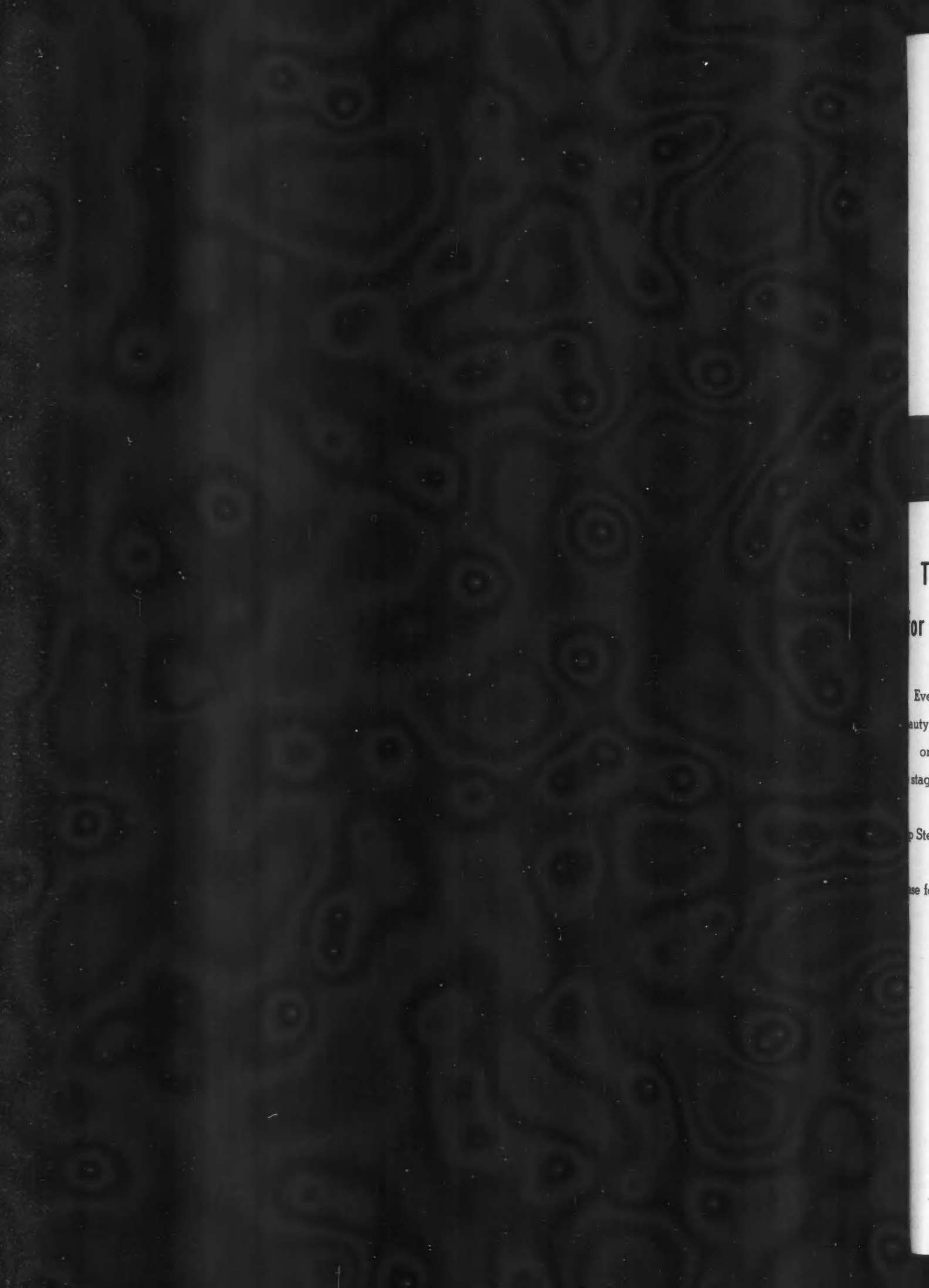
The R-2180 Twin Wasp, a new two row, 14 cylinder radial engine, is now being tooled for production by the Pratt & Whitney Aircraft Div., United Aircraft Corp. Deliveries early in 1949 are expected. Designed for use in 30 passenger two-engined transports, at speeds up to 250 mph, the new engine type features a two unit carburetor with the throttle and air measuring mechanism mounted in an updraft position and with the fuel control unit mounted on the side of the rear section. The fuel control unit is unusual in that it houses an engine driven fuel pump. The use of external high pressure fuel lines is thus avoided. The fuel pump is part of the engine and is certificated with it.

The new engine type is offered in  
(Turn to page 106, please)



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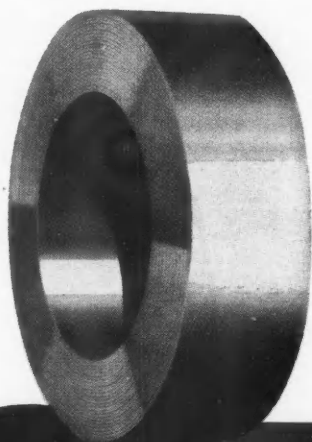
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**Superior**

STAINLESS STRIP STEEL

The **RIGHT, BRIGHT** metal  
for transportation equipment

Everywhere in transportation—for permanent beauty or solid wear resistance—stainless steel is on the move. And moving smoothly through stages of stainless equipment manufacture are bright ribbons of SUPERIOR Stainless Steel . . . providing, through our specialized control of quality, outstanding handling ease for the fabricator . . . steel that is "always on good behavior." May we send you our comprehensive Stainless Brochure?

**LUSTROUS**

**SOLID**

**PERMANENT**

**EASY TO  
FABRICATE**

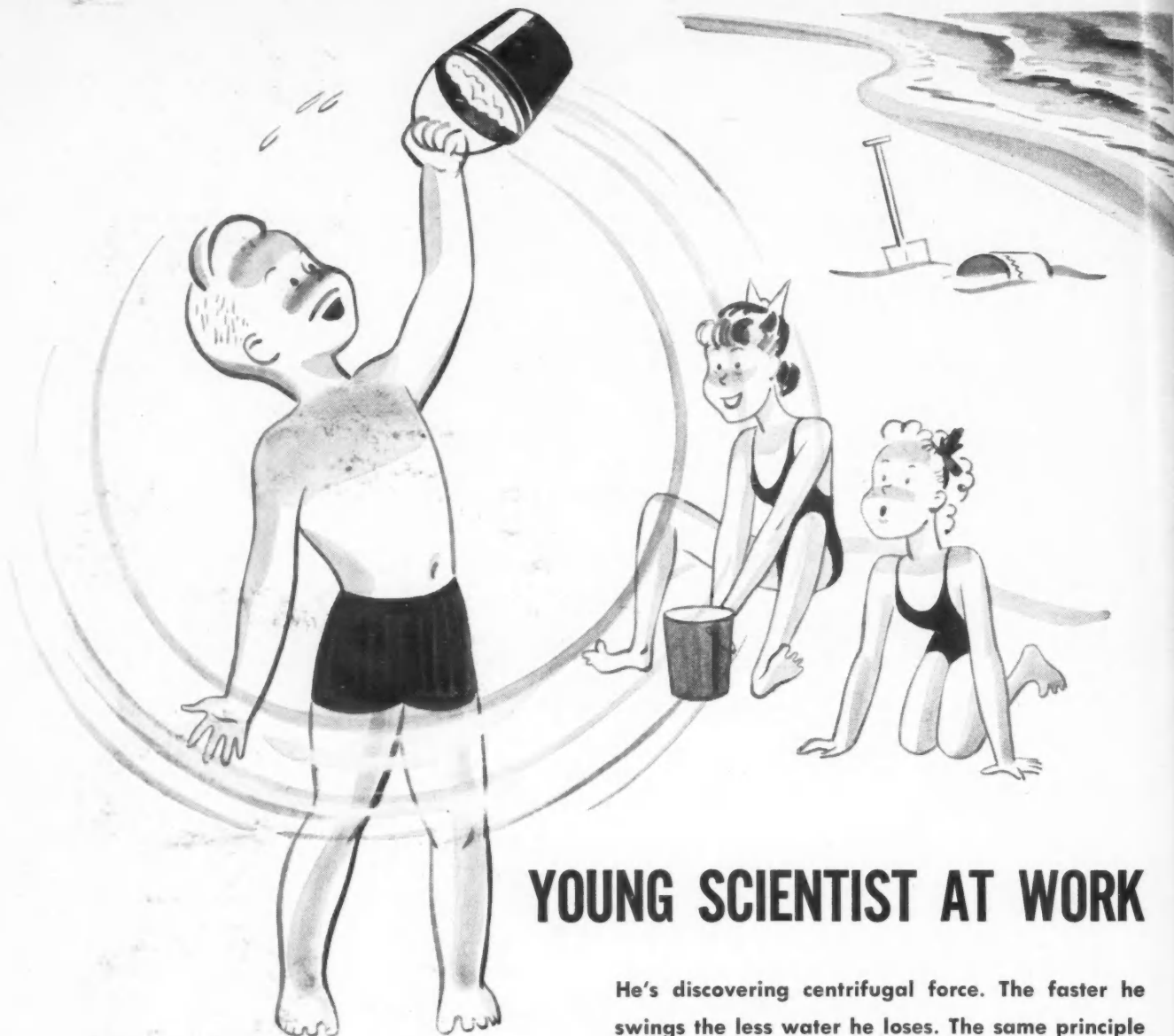


**Superior Steel**

CORPORATION  
CARNEGIE, PENNSYLVANIA

101

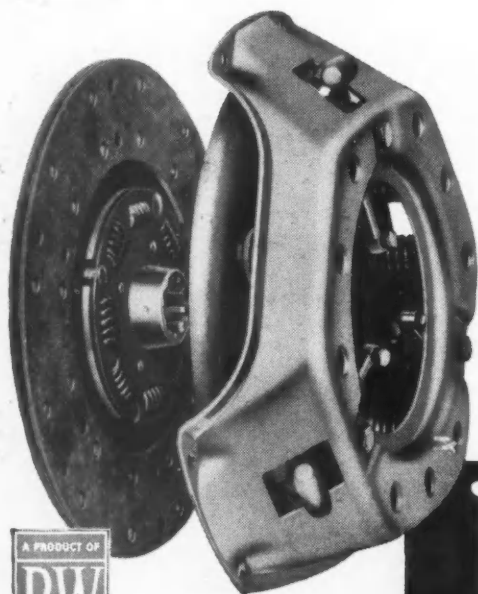




## YOUNG SCIENTIST AT WORK

He's discovering centrifugal force. The faster he swings the less water he loses. The same principle employed in our semi-centrifugal clutches provides easy pedal action in traffic driving *plus* increasingly stronger "grip" as engine speed increases. This means less slippage and wear, and longer service. Millions of cars, trucks, buses and tractors have been equipped with Long clutches since 1922.

**LONG MANUFACTURING DIVISION**  
**BORG-WARNER CORPORATION**  
 Detroit 12, and Windsor



# LONG

**CLUTCHES • RADIATORS • OIL COOLERS**

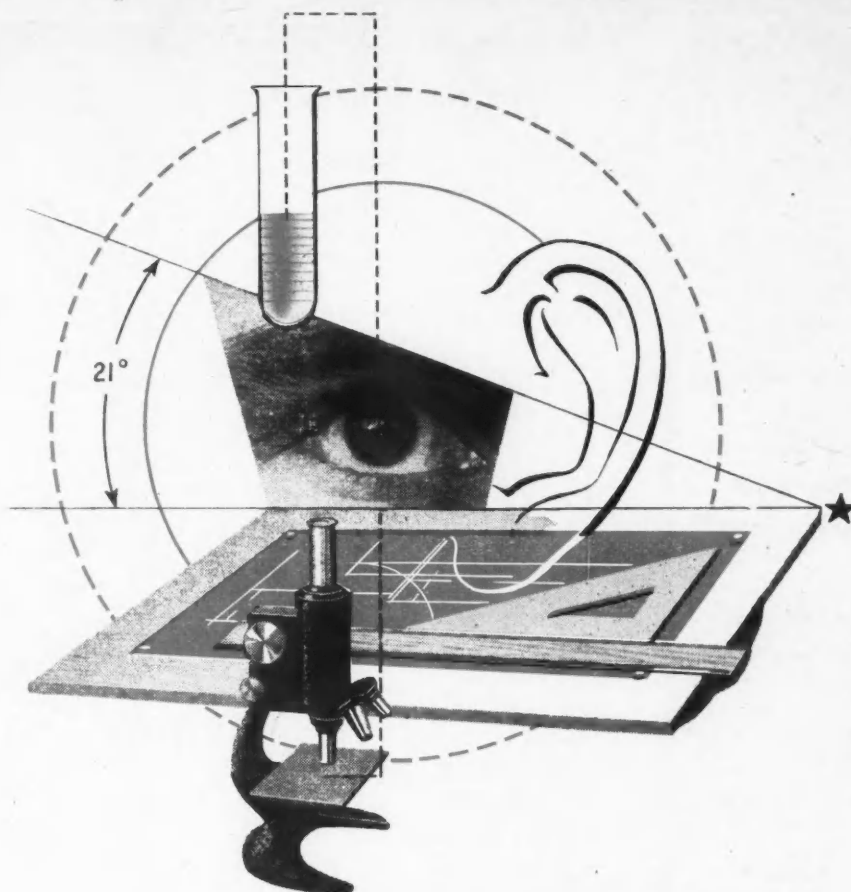


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## AND THE **KNOW HOW** IS FREE

You may have an equipment\* problem in which AC's 39 years of "know-how" will be of great value, to your engineers, your production heads, your sales department . . . or all three. For the improvement of a product, in quality, just as well as in sales appeal, may often be accomplished by "know-how," rather than by simply increasing the cost. The "know-how" is free.

Perhaps your "know-how," plus ours, would be very productive. Certainly, it will pay you to investigate AC's wide variety of standard and special equipment units, used by many of America's foremost builders of vehicles and engines. Your inquiries are solicited and will receive prompt attention.

### AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION

General Motors Bldg.  
Detroit 2, Michigan

Mott Foundation Bldg.  
Flint 3, Michigan

73 E. Wacker Drive  
Chicago 1, Illinois

\* AIRCRAFT SPARK PLUGS • AIR CLEANERS • AMMETERS • CARBURETOR INTAKE SILENCERS • CARBURETOR INTAKE SILENCER AND AIR CLEANERS • CRANKCASE BREATHERS • CRANKCASE VENTILATION VALVES • DIE CASTINGS • DIE CASTING MACHINES • BACK FIRE DEFLECTORS • FLEXIBLE SHAFT ASSEMBLIES • FUEL OIL FILTERS • FUEL PUMPS • FUEL AND VACUUM PUMPS • GASOLINE GAUGES • GASOLINE STRAINERS • IGNITION CABLE TERMINALS • INSTRUMENT PANELS • LUBRICATING OIL FILTERS • OIL FILTER REPLACEMENT ELEMENTS AND CARTRIDGES • AIR GAUGES • OIL GAUGES • RADIATOR PRESSURE CAPS • REPLACEABLE AIR CLEANER ELEMENTS • AUTOMOTIVE SPARK PLUGS • SPARK PLUG CLEANERS • SPARK PLUG GAPPING TOOLS • SPARK PLUG TESTERS • SPEEDOMETERS • SPEEDOMETER AND TACHOMETER DRIVE ADAPTERS • TACHOMETERS • THERMO GAUGES • VACUUM PUMPS • VOLTMETERS





**"Here is  
another example of  
SUPERKOOL  
superiority for  
precision grinding"**

**... excerpts from  
D. A. Stuart Oil Co.  
Performance Report  
on SUPERKOOL 31K**

**PROBLEM:** Precision grinding finish of 4 to 6 micro inches required on compressor valve units, using a 500 grit wheel on Norton Hyprolap machines. Previous mixture of 1 part kerosene and 2 parts red engine oil unsatisfactory.

**SOLUTION:** Use of a 1 to 1 blend of SUPERKOOL 31K and kerosene.

**RESULTS:** Operator reported less mist from the machine... Production increased to 200 pieces... Finish improved 2 to 4 micro inches... subsequent tests proved completely satisfactory results by using SUPERKOOL 31K straight on micromatics, and the above dilution on the Hyprolap machines... Foreman and lubrication engineer well pleased... orders for SUPERKOOL 31K to be placed as required.

*D. M. Giblin*

D. A. Stuart Oil Co., Representative

**STUART service goes  
with every barrel  
WRITE FOR DETAILS**



**D. A. Stuart Oil Co.**  
EST. 1905 LIMITED

2733 SOUTH TROY STREET, CHICAGO 23, ILL.

## Chevrolet Trucks

(Continued from page 35)

and floor mats provide a cooler and quieter interior. All cab sheet metal subject to wheel splash or moisture is coated to prevent rusting. Fenders, grille and hood of conventional and COE models are of new design.

Pick-up bodies for the new line have been strengthened and their utility increased by elimination of the wheelhouse. All pick-up bodies have a usable width of 50 in. for the full length.

Panel bodies in the line are entirely new and stronger through redesign of floor sills, body-side top rails, and top upper rails. In addition there is greater use of rust inhibiting paints for body protection. On the 3105 model the body has 150 cu ft of load space, an increase of 13 per cent, and will accommodate up to 10 ft of length for merchandise alongside the driver. The 3805 model, with 6700 lb GVW, has a load space of 202 cu ft and will accommodate merchandise up to 12 ft 6 in. in length alongside the driver. Panel bodies are wider, and have a minimum width inside the wheelhouse of 48 1/4 in.

On platform bodies the round front corner has been retained as protection. Stake bodies have square front corners to facilitate loading. On models 3608 and 3609 the sills have been reduced one in. to provide lower loading height.

The frames of all trucks have been re-designed and strengthened. In the light-duty models gusset plates have been added to stiffen the frame and to maintain side rail alignment. On the Loadmaster models the side rails have been extended beyond the front springs to support the bumpers. Frames for heavy duty models (over 11,000 lb GVW) are entirely new, featuring larger size and larger section modulus. Side rail depth is 8 3/8 in. with a flange of 2 3/4 in. and a thickness of 1/4 in. This frame is used in all models of the series 4400, 4500, 5000, and 6000 (except 6702), and is included in the heavy-duty option group for the 4100 series.

Springs for all models carry new ratings stated in terms of weight on the tires at the ground, and all springs have capacity equal to or in excess of axles and tires. Front springs on the series 3100 and 3600 are two in. longer. Front spring hangers are installed on all series for greater strength. Front spring bumper retainers have been re-designed for more positive retention of the bumper. Wide base wheels have been adopted as standard equipment, producing straighter tire sidewalls, better road contact, and increased air volume under load.

These trucks are offered in 12 colors or any two-tone color combinations, maroon and beige having been added to the former range.



Conformity to your specifications is guaranteed by the unequalled accuracy of Booth dies.

Booth uniformity of quality and cutting will show you immediate time-savings in assembly of parts. Quality plus Experience is the only sure formula for complete satisfaction.

APPLICATION CHART AND SAMPLE KIT... contains swatches of S.A.E. felt types, with specification tables. Write for it. (No sales follow-up.)

**THE BOOTH FELT COMPANY**  
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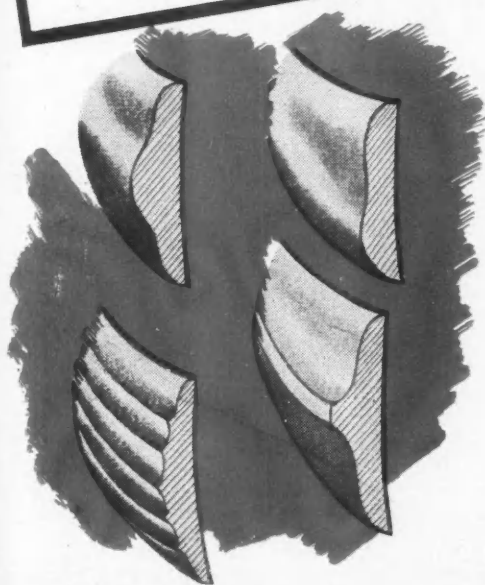
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FELT PARTS**



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High-Strength ALCOA  
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When you think of aluminum for automotive parts, it's natural to think of Alcoa. Our automotive experience extends unbroken from the first use of this metal in automobiles more than 45 years ago, and offers practical help in problems of alloy choice and fabrication. Alcoa recommendations will be unbiased, for our facilities permit production by sand, semi-permanent or permanent-mold casting, by forging, regular or impact extruding, or whatever method is called for in your case, to give you best results. Call your nearest Alcoa sales office, or write ALUMINUM COMPANY OF AMERICA, 2110 Gulf Building, Pittsburgh 19, Pennsylvania.

**ALCOA FIRST IN ALUMINUM**

IN EVERY COMMERCIAL FORM





# General News

(Continued from page 100)

two single stage models: the R-2180 E1 has a single speed supercharger and is suitable for medium altitude flights, or with a turbo supercharger for very high altitude work; the R-2180 E12 model has a two speed supercharger for high altitude flights.

Ratings of the R-2180 E1, or the R-2180 E12 engine using the low impeller gear ratio are: take-off power, 1650 hp at 2800 rpm up to an altitude of 3000 ft; normal rated power, 1300 hp at 2600 rpm to 8000 ft; maximum continuous power, 1400 hp at 2600 rpm to 6000 ft. Using the high impeller gear ratio, the two-speed E12 engine has the following ratings: take-off power, 1300 hp at 2800 rpm to 10,000 to 16,000 ft; normal rated power, 1150 hp at 2600 rpm to 17,500 ft; maximum continuous power, 1250 hp at 2600 rpm to 15,500 ft. The engine also has provision for the use of water injection to increase its take-off rating to about 1800 hp. Weight of the two-speed engine is 1900 lb, the single speed engine weighing 15 lb less. For both models, the engine diameter is 50.1 in., the length, 75.2 in. The cylinder bore is 5.75 in. and the stroke is 6 in.

## North American Stops Navions

North American Aviation, Inc. has discounted production of the Navion, its four place personal airplane. The demand for personal or small executive planes is too small to support the high production required, according to a study by North American. Up to the date production was stopped on April 14, 1100 Navions were produced.

## Bayne Leaves Plymouth For Ford Sales Post

Announcement that Joseph E. Bayne, general sales manager of Plymouth at Chrysler Corp., had resigned to become general sales manager of Lincoln-Mercury Div. at Ford Motor Co. marked the first departure of a major Chrysler official to join the Ford organization. Heretofore, Ford has obtained many of its present top ranking executives from the ranks of GM.

## New Buick Estate Wagon

A new six-passenger Buick Roadmaster Estate Wagon model, built on the Series 70 Roadmaster chassis, was introduced recently by the Buick Motor Div., General Motors Corp. Featuring airfoil fenders, the Estate Wagon is built on a 129-in. wheelbase.

## Corrections to Kit Kamper Article

Certain corrections have been made to an article published in the May 1 issue of AUTOMOTIVE and AVIATION INDUSTRIES, entitled "New Torsion Rod Suspension Features Welded Construction," by Given Brewer, which described road tests and stress analysis of a trailer known as the Kit Kamper.

The ratio of sheer permanent set to axial set, incorrectly given on page 26 as 1.5, has been re-calculated and found to be 0.75. This change does not affect the test results since the measured shear modulus, instead of the calculated value, was used for the analysis. However, the calculated and measured values of  $\frac{T.M.}{Z_p}$ , as shown by the curves of Fig. 2 on page 24, will be in more close agreement.

In Table II on page 27, the column headed "Acceleration Deficiency" should be "Accelerometer Deflection." Also, errors appeared in two formulae on page 26. These formulae should have been as follows:

$$T.M. = \frac{r_i^3}{2} \cdot \pi \cdot f_{sp} + \int_{r_i}^{r_o} f_a \cdot 2 \pi r^2 dr$$

$$\frac{r_i}{r_o} = \frac{f_{sp}}{f_{sa}}$$

## The New GEARGRIND Heavy Duty—Constant Velocity UNIVERSAL JOINT



**Delivers CONSTANT VELOCITY  
Over the Entire Range**

**Free From Torsional Vibrations  
at All Operating Angles and Speeds**

● This new high angle, heavy duty propeller shaft universal joint is now in production, after years of severe testing under extreme operating conditions! Enables the engineer to design to meet his particular requirements, because perfectly balanced, compensating joint operating angles are not required as they are with the ordinary cross type joint.

Torque is transmitted through steel balls, positioned in intersecting race ways. A heavy ball socket in the center positions the driving members and maintains true concentricity. The entire joint assembly is completely enclosed, oil being retained by a large tube, pressed on one member and connected to the other by a neoprene diaphragm. Deliveries of certain sizes are now being made.

Full Information on Request



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Automotive clutch collar, made from SAE 4047 steel.

## NOW THEY'RE GROUND BEFORE HEAT TREATMENT

Before martempering was adopted by the manufacturer of these clutch collars it was necessary to grind the flange and outside diameter after heat treatment. Warp and growth caused by conventional heat treatment altered dimensions.

But a quench in hot oil corrected that. Now these parts are heated to 1550° F. in a cyanide bath (15-20 minutes), then quenched in Houghton's MAR-TEMP OIL at 300-320° F., held there for two minutes, then air-cooled.

Grinding, except for inside diameter

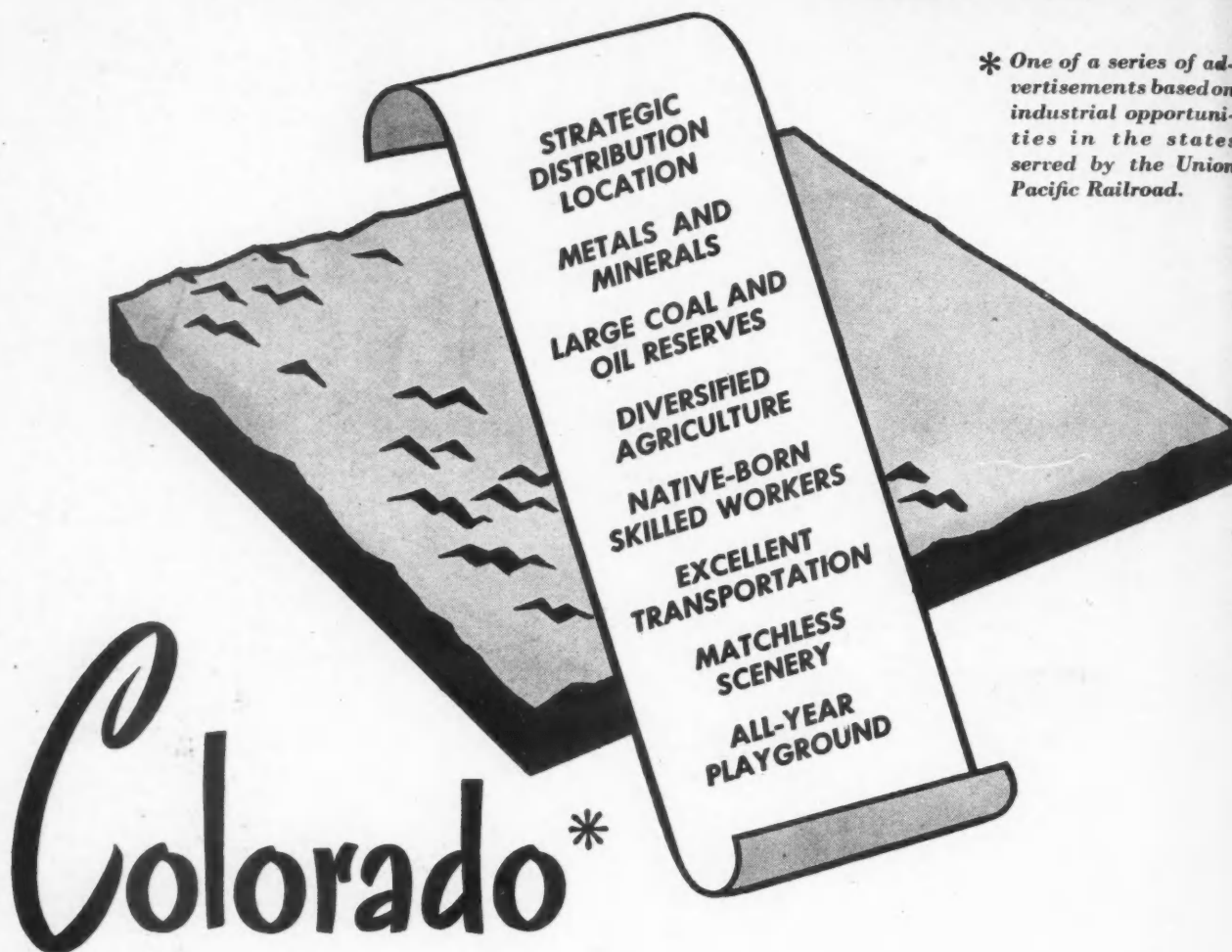
is now done before heat treatment, which makes for easier machining. Distortion is ended by the interrupted quench in hot oil.

MAR-TEMP OIL, used on this particular operation for nine months, has shown exceptionally slight change in viscosity, indicating its stability under continued heating.

The hot oil quench may be your answer to a warp or distortion problem. We suggest you discuss it with the Houghton Man, or send your problem to E.F. Houghton & Co., 303 W. Lehigh Ave., Phila. 33, Pa.

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**MAR-TEMP OIL**  
**FOR HOT QUENCHING**

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**TREASURE MAP OF INDUSTRY**



\* One of a series of advertisements based on industrial opportunities in the states served by the Union Pacific Railroad.

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More than 250 useful metallic and non-metallic minerals and compounds have been found, including precious uranium. Timber, oil and coal are practically unlimited.

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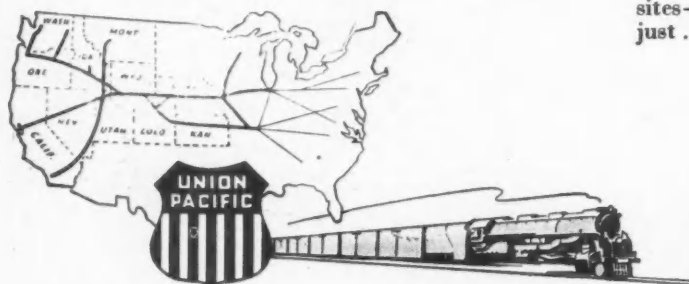
resulting in fewer "time-outs" assure economical production.

Colorado provides sound state economy, modern educational and cultural facilities.

Thousands of vacationists enjoy its mountainous splendor, cool summer breezes and winter sports.

Union Pacific provides Colorado with unexcelled freight and passenger transportation. Every night, over night Streamliner service between Denver-Chicago . . . Denver-St. Louis.

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 say "Union Pacific"**

\* Address Industrial Department, Union Pacific Railroad, Omaha 2, Nebraska, for information regarding industrial sites.

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**THE STRATEGIC MIDDLE ROUTE**







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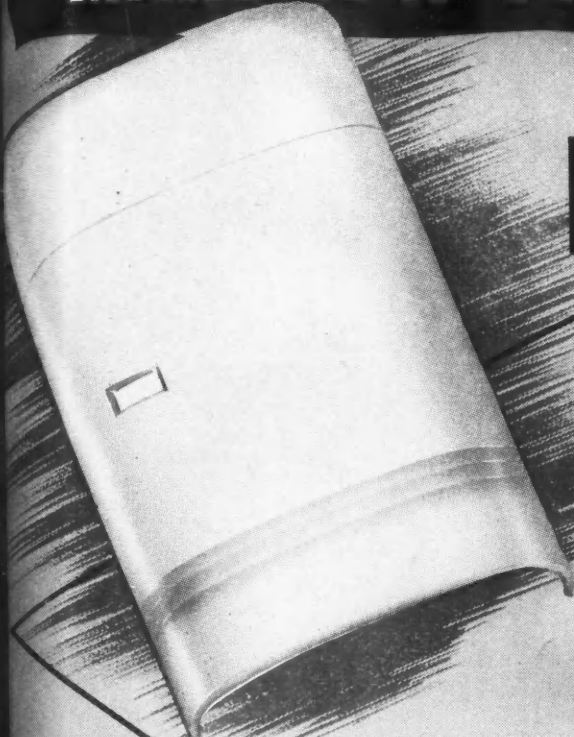
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**MAKE 1947 PRODUCTS ON . . .**

# 1947 PRESSES



New design—improved mechanical features—greater storage space! The new 1947 refrigerator!

To manufacturers who are continuously improving product design and mechanical features, Danly offers a line of mechanical presses that will put the same efficiency into *production facilities* that have been engineered into your product. Danly Presses have the rugged construction and mechanical accuracy that makes for faster runs, more accurate stampings, longer die life, less downtime and *greater production*—the kind of performance to step up production to 1947 standards of efficiency.

The modern enclosed construction of these presses saves valuable floor space—especially in rows or batteries—keeps working parts free of dust and dirt.

Keep your productive equipment geared to the modern trend of the products you manufacture.


MAKE 1947 PRODUCTS ON 1947 PRESSES

**THE PRESS FOR  
MODERN PRODUCTION**

**DANLY**  
**MACHINE SPECIALTIES, INC.**

2100 S. 52nd Avenue

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This 300-ton 4-point press is typical of the Danly line of one, two and four point models which range in size from 100 tons up—special sizes and adaptations built to customer specifications.



Raw materials of the highest quality . . .  
 heat-treated alloy steels, grey iron castings of high nickel content for tensile  
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 durability in Fuller Transmissions.

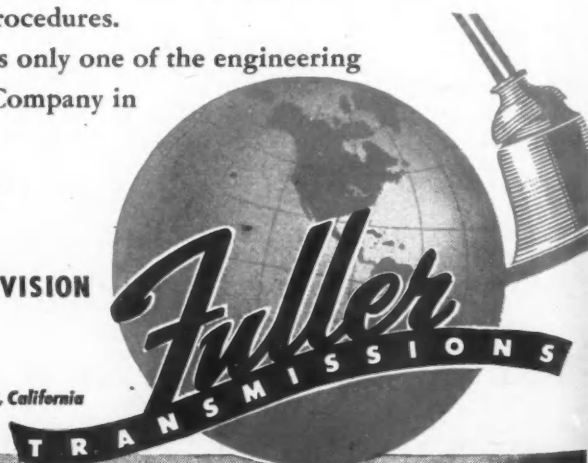
Equally important is the engineering control exercised over manufacturing  
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Controlled quality of materials and standards is only one of the engineering  
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 quiet-running . . . easy-shifting . . . long-lasting.

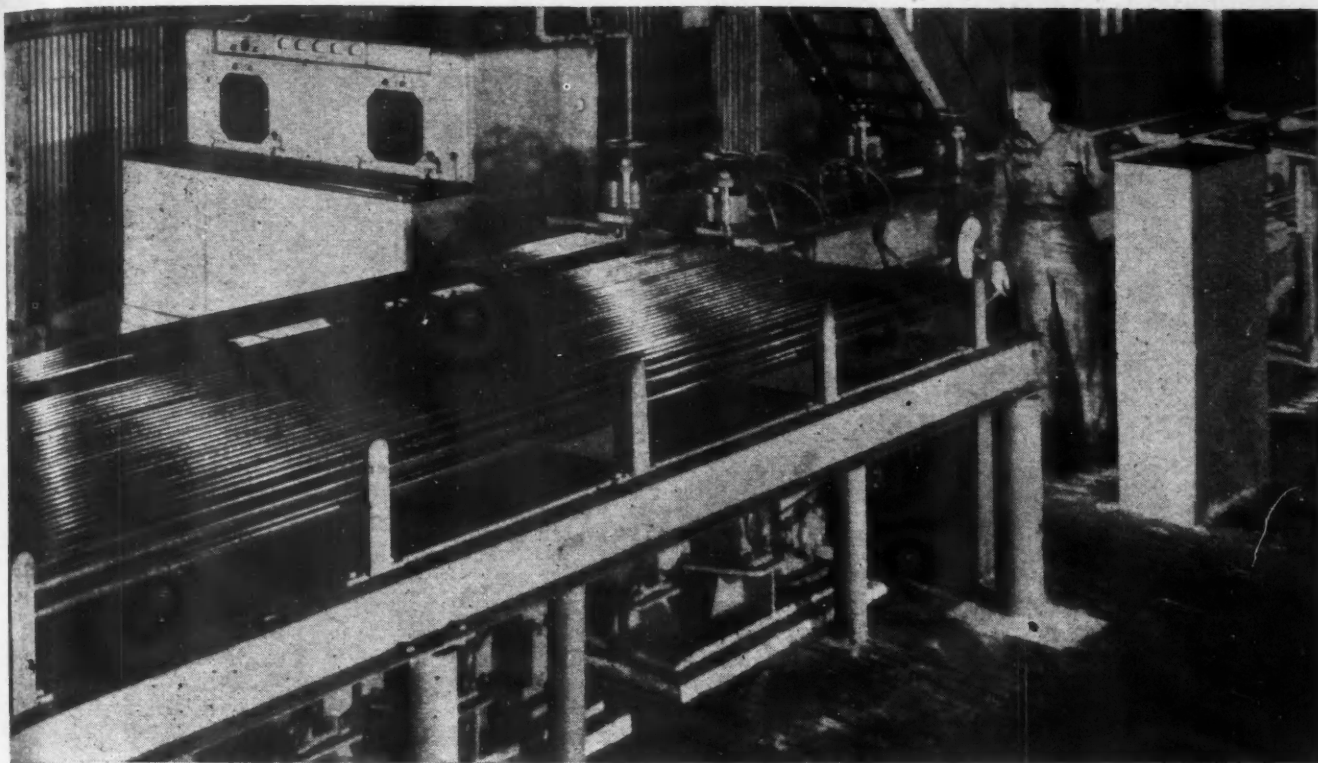
**FULLER MANUFACTURING COMPANY, TRANSMISSION DIVISION**  
**KALAMAZOO 13F, MICHIGAN**

*Unit Drop Forge Division, Milwaukee 1, Wisconsin*

*Western District Office (Both Divisions): 308 Thayer Building, 577 14th Street, Oakland 12, California*







## J & L steps up *Quality* of bars with TOCCO Induction Hardening

● Jones & Laughlin Steel Corporation, the first steel company to use induction hardening for treatment of steel bars, reports that it is passing on to its customers these benefits in improved quality:

1. **INCREASES UNIFORMITY** of metallurgical structure as to *hardness* and *depth of hardness*—throughout its entire length and cross-section.

2. **IMPROVES MACHINING.** Elimination of hard and soft spots promotes consistent uniformity of machining.

3. **IMPROVES SURFACE.** Speedy, localized hardening practically eliminates scale and distortion for greater product quality.

4. **MINIMIZES METAL LOSS.** Less skin removal through decarburization.

J & L is now TOCCO hardening cold-finished round bars in lengths of 10 ft. to 24 ft., in diameters of  $\frac{1}{2}$ ",  $\frac{3}{4}$ ",  $\frac{7}{8}$ ", 1",  $1\frac{1}{8}$ ",  $1\frac{3}{8}$ " and  $1\frac{7}{8}$ "; will process 2" bars soon; and expects also to treat flat and hex stock.

The completely automatic work handling equipment with TOCCO Induction Heating unit is shown above. Controls are readily adjusted to suit the size of bars to be treated and the degree and depth of hardness desired.

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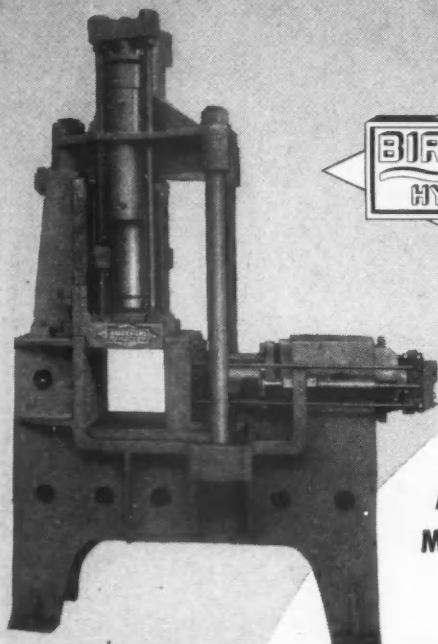
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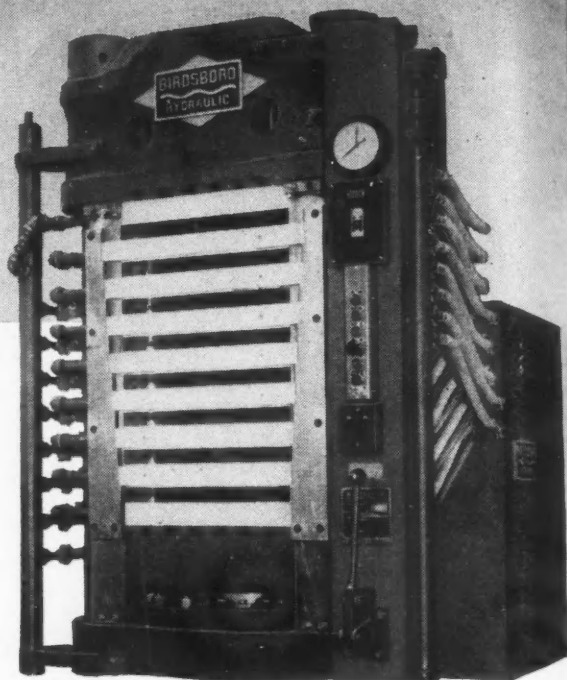


# TOCCO



Laminating

Angle  
Molding



## HYDRAULIC PLASTIC PRESSES

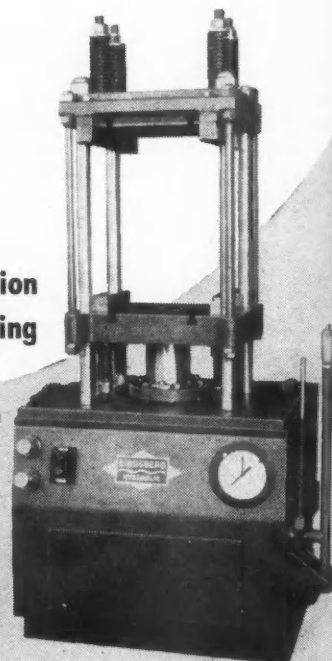
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Here are three A.C.-D.C. electrodes that meet approximately 61% of all general-purpose, mild steel welding requirements — on production lines, or special jobs.

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- ... Low Spatter Loss
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# WIDE RANGE OF STANDARD LOW PRICED CARBOLOY BLANKS AVAILABLE FROM STOCK

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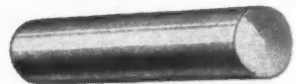
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Adaptable to solid boring tools, tool bits and wear resistant uses, a stock of these solid Carboloy cylinders in your tool crib will provide for many uses.

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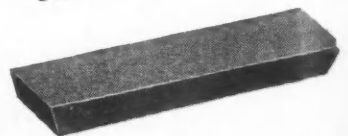
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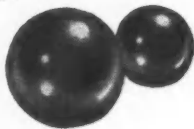
For economical drilling of cast iron and non-ferrous metals. Priced from 15c up. Wide range of sizes. Immediate deliveries.

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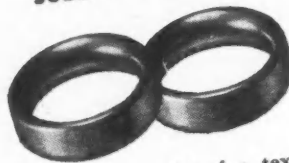
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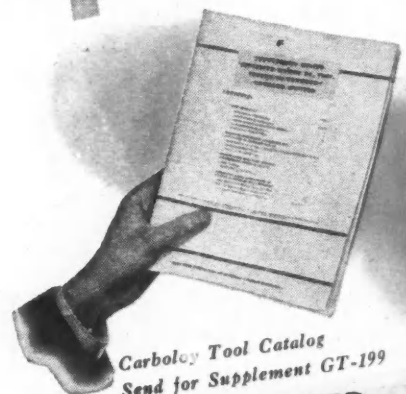
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Standards are stocked in 74 cities coast-to-coast

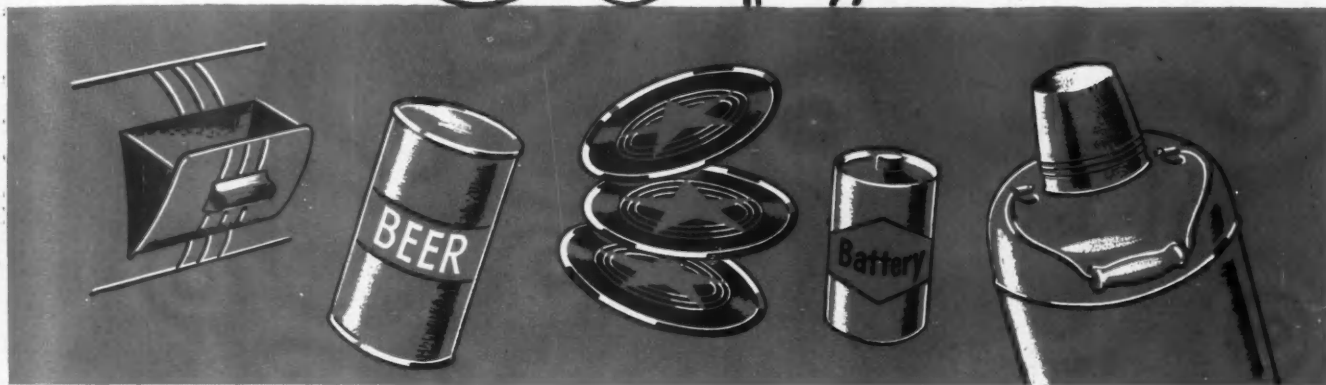
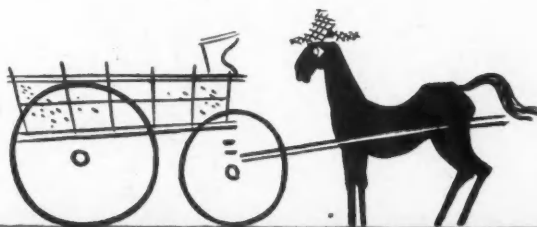
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Carboloy Tool Catalog  
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# It pays to put this cart before the horse



Sometimes it pays—and pays handsomely—to “paint” an article *before* you manufacture it!

If it's made of metal, *coat it in the flat sheet* with a tough, flexible plastic coating based on VINYLITE Brand resins. Then *form and draw and crimp and stamp* it into the finished shape. All other painting or decorating is eliminated! You've saved a costly and time-consuming step in the manufacturing cycle.

Such coatings defy abuse. Air-dried or low-baked, they survive the manufacturing process without a mar—and last through years of brutal punishment in actual service. They are tasteless, odorless, non-toxic . . . and, when properly formulated, they are highly resistant to moisture, alkalis, acids and other chemicals. Naturally, therefore, VINYLITE resin coatings are virtually in a class by themselves for use as linings—for tanks, vats, food and beverage containers and closures.

Have you tried putting the cart before the horse?

Write Department CB-15 for information or aid—technical data on properties, uses and formulations of VINYLITE resin coatings.

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June 15, 1947

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When you talk to him . . .



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# e talking to the mill!

## Our alloy metallurgical service keeps you in direct touch with "alloy steel headquarters"

WE emphasize this fact because it is important. For we believe that our alloy metallurgical representatives can serve you best if they are in close and intimate contact not only with your problems but with what our mills and laboratories are doing as well.

The metallurgical representative we assign to contact your plant has been carefully selected because of his special knowledge of the requirements of your business. Although he is on immediate call to give you expert advice whenever you need it, he must spend much of his time at headquarters where he keeps fully informed of the latest developments in alloy steel research and in new uses for alloy steel. He is, in fact, part of our operating department. So,

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When a tougher than usual alloy steel problem comes up, he himself takes it back home to work out the details side by side with our technical staffs. In other words, he acts as *your* personal representative to see that your problem gets the best attention Carnegie-Illinois can give it.

By this direct, personalized service you are assured of receiving at first hand, constant experienced help in alloy steel selection and use, and the most up-to-date information developed by our research and producing departments. It makes a difference in the better results you get in applying U·S·S Carilloy Steels to your needs.

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## *Did you know?*

... That at Carnegie-Illinois Steel Corporation there are four distinct technological staffs assigned to service adequately every need, whether it be (1) pure research, (2) steel manufacturing and processing research, (3) research on new steels and new uses of steel, or (4) technical service to the consumer.

... That in addition to this, consumers or users of steel are also provided with a wealth of information made available by the technological service of sister companies—American Steel & Wire Company, National Tube Company, Columbia Steel Company, and Tennessee Coal, Iron & Railroad Company, as well as those most important research studies provided by the United States Steel Corporation's Research Laboratory at Kearny, New Jersey.

# S T E E L

U·S·S Carilloy Steels

U·S·S STEEL  
UNITED STATES STEEL

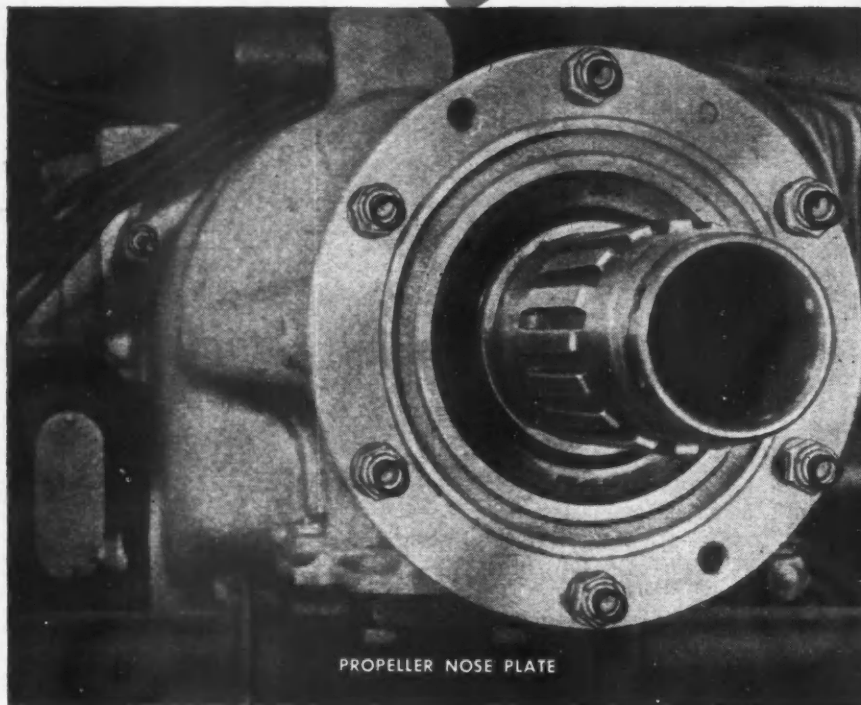
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*Prestressed  
Settings*

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PROPELLER NOSE PLATE



FRANKLIN "500" AIRCRAFT ENGINE  
215 HP — 2,500 RPM

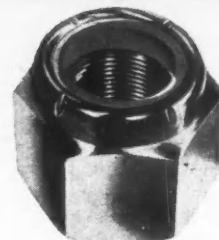
*The Red Elastic Collar provides  
dependable protection against VIBRATION!*

Two sources of vibration combine their efforts to loosen the detachable fasteners on the propeller nose plate of the Franklin "500" Aircraft Engine. Continuous engine vibration and fluctuating blade flutter, caused by turbulent air, make each prestressed setting a potential trouble spot. Conventional fasteners would shake loose. But ESNA Elastic Stop Nuts hold fast!

The reason for the dependable ESNA protection is the Red Elastic Collar that has become a symbol of security to all aviation engineers. Its full contact grip on the bolt or stud threads and its metal

thread seating action make all Elastic Stop Nuts self-locking and self-sealing. As a result, they protect against Vibration, Thread Corrosion, Thread Failure and Liquid Seepage.

ESNA experience and research are always at the disposal of the aviation industry. Industrial distributors are stocked and ready to give prompt service. For further information address: Elastic Stop Nut Corporation of America, Union, New Jersey. Sales Engineers and Distributors are now conveniently located in many principal cities.



**LOOK FOR THE RED COLLAR  
THE SYMBOL OF SECURITY**

It is threadless and dependably elastic. Every bolt—regardless of commercial tolerances—impresses (does not cut) its full thread contact in the Red Elastic Collar to fully grip the bolt threads. In addition, this threading action properly seats the metal threads—and eliminates all axial play between the bolt and nut.

All ESNA Elastic Stop Nuts—regardless of size or type—lock in position anywhere on a bolt or stud. Vibration, impact or stress reversal cannot disturb prestressed or positioned settings.



**ELASTIC STOP NUTS**



INTERNAL  
WRENCHING



ANCHOR



WING



INSTRUMENT  
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THIN  
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GANG  
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CAP

PRODUCTS OF: ELASTIC STOP NUT CORPORATION OF AMERICA



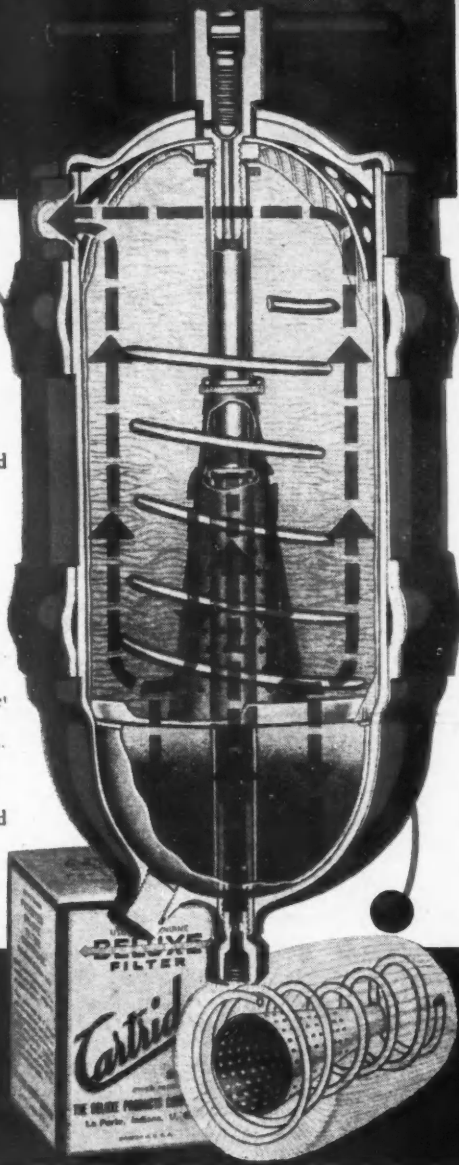
**HERE'S WHY...**  
there's no  
"just as good"!

No short-cuts for oil in DeLuxe—it has to take the long road! Travels entire depth of cartridge top-to-bottom, insuring prolonged exposure to filter material... complete removal of contaminants **BEFORE** they form injurious sludge!

No cartridge-clog in DeLuxe—the cone drops sludge directly into the sump! Distributes the oil uniformly at the cartridge base. **NOTE** that the oil enters at just one point in the center of filter so that for free flow of oil to base of cartridge the conical space provided by the cone is **ESSENTIAL**.

No pack-down in DeLuxe—the spring supports filter material to eliminate gradual wadding and consequent filter inefficiency! Oil keeps moving the **L-O-N-G** way, the **RIGHT** way!

**Remember**  
ONLY DELUXE CARTRIDGES  
HAVE THE BUILT-IN CONE  
AND SPRING. Both are  
essential to FILTRATION that  
ACTUALLY CLEANSSES OIL!



most **EVERY** new truck, bus and  
engine you see today  
is **DELUXE** equipped  
(or optional equipment)

Day by day, more and more engines equipped with DeLuxe Oil Filters are going into service! Chances are, some or all of *your* present units are already so equipped.

If so, it is highly important for you to see to it that **ONLY** genuine DeLuxe Refill Cartridges go into these filters... for they alone assure proper operation! Their exclusive cone-and-spring construction is essential to **FULL** DeLuxe efficiency. Using a substitute for their purpose means losing out on the many benefits gained **ONLY** when DeLuxe Filters and Cartridges work together!

It is this combination that has made DeLuxe the favored filter with so many leading engine builders—makes it *your* logical choice for maximum economy and efficiency. And always be sure of full DeLuxe protection, by always being sure to have DeLuxe Cartridges on hand! They're available through DeLuxe Jobbers nation-wide. **SEE YOURS TODAY!** DeLuxe Products Corp., 1414 Lake St., La Porte, Ind.

**DELUXE**  
*Oil Filter*  
DOES MORE THAN STRAIN OIL... MORE THAN FILTER OIL  
**ACTUALLY CLEANSSES OIL**

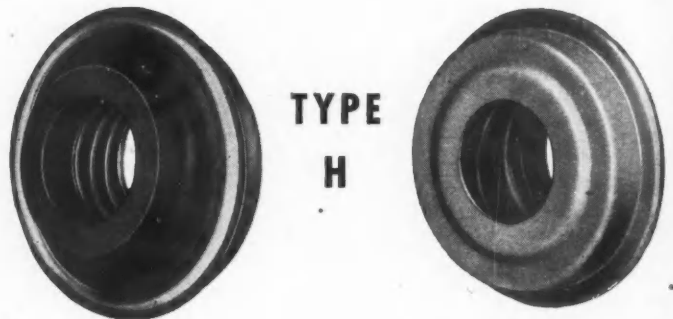


# AQUA-TITE

## A New and Advanced AUTOMATIC SHAFT SEAL



Developed to meet the demands for a perfect automatic shaft seal for all purposes. It has a rare combination of advantages in that it is extremely simple, costs less, saves machining and installation costs, and will do a better job of sealing through a longer life like all Aqua-Tite seals.



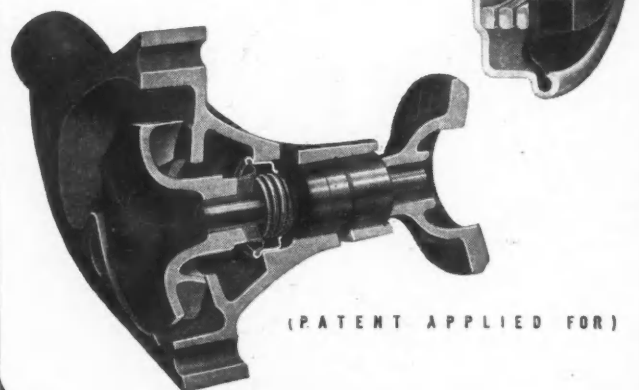
### OUTSTANDING FEATURES...

- ★ Comes as a single unit.
- ★ One piece only to handle.
- ★ One sealing surface only.
- ★ Consequently—less spring pressure—less wear.
- ★ No slots in pumps or impellers.
- ★ Fool proof—only one way to assemble.
- ★ Easy to install, easy to replace.

The sealing disc is made of a carbon alloy, a material recognized as superior for the purpose. It is securely bonded integrally to the rubber housing and thus eliminates the sealing disc as a separate piece and, consequently, one of the faces to seal. This reduces the usual functions of the spring to keeping only one set of surfaces in sealing contact. . . . The materials used in the Type H seal are the same so carefully selected and proven in millions of other Aqua-Tite seals. All metal parts are non-corrosive and the important spring is safely protected inside the seal.

Cutaway view of (left) Type H seal installed in an automobile water pump housing, (right) Type H seal itself

Note the utter simplicity of both pump housing and impeller—how core making and machining costs of pump are reduced.



**A COMPLETE WATER PUMP SERVICE**—a fine seal—a fine impeller—or a complete pump for your new product or improving present models. Send us your inquiries. We have advantages in both performance and price.

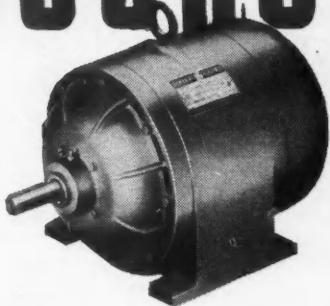
Send today for Our New Book — "Automatic Shaft Seals" — a Schwitzer-Cummins Development

**SCHWITZER-CUMMINS COMPANY**  
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# 5 BILLION MOTOR HOURS

PROVE YOU  
CAN'T BEAT



## TRI CLAD EXTRA PROTECTION

Announcement of the Tri-Clad motor, back in 1940, ushered in a new concept of general-purpose motor design. Substantially increased horsepower-per-frame-size was one feature. Smarter appearance was another. But what really sold more than a million Tri-Clad motors is the *extra protection* we built into them. Figured conservatively, they have delivered more than 5 billion hours of service.

Today, with the "family" including dripproof motors, vertical motors, gear-motors, capacitor-motors, and totally enclosed motors, the Tri-Clad motor is, more than ever, the motor that means basic protection, dependable performance, and minimum upkeep. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

### EXTRA PROTECTION...AGAINST PHYSICAL DAMAGE!

Rigid cast-iron frame and end shields protect vital parts from external abuse and prevent resonance. Because they're not at the mercy of a coat of paint, they strongly resist chemical attack and dampness. Cast iron also gives you tight, *metal-to-metal* fits between end shields and frame.

### EXTRA PROTECTION...AGAINST ELECTRICAL BREAKDOWN!

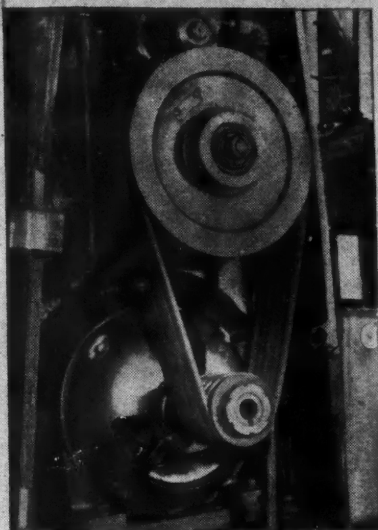
Windings of Formex\* wire, together with improved insulating materials, reduce the chances of electrical failure. Heat is dissipated quickly—motor stays young for years and years.

### EXTRA PROTECTION...AGAINST OPERATING WEAR AND TEAR!

Bearing design affords longer life, greater capacity, improved lubrication features. Bearing seals retain lubricant, keep out dirt. One-piece, cast-aluminum rotor is practically indestructible.

\*Trade-mark reg. U.S. Pat. Off.

**GENERAL  ELECTRIC**  
750-286C



### 5 YEARS IN "SOLITARY"

Many machine tools in the Bell Aircraft plant at Buffalo have pioneer Tri-Clad motors tucked away inside. The result is a sleek exterior for the machine and valuable floor space saved. During the war, when time was short and uninterrupted protection was of utmost importance, these motors gave dependable service, demanding only a minimum of maintenance and inspection. The Tri-Clad motor you see here driving a milling machine has not been removed for five years. It has done its job faithfully despite the strain of a 3-shift, 7-day work schedule, and along with 200 other Tri-Clad motors in the Bell plant, gives every sign of staying on the job indefinitely.

### NOW—PEAK MOTOR TOUGHNESS

The Tri-Clad totally enclosed, fan-cooled motor is designed for use in adverse atmospheres—in iron dust, out-of-doors, in hazardous areas, and chemical atmospheres. It gives you these important construction features:

- A cast-iron, double-wall frame which completely encloses and protects windings and punchings.
- A nonshrinking compound around motor leads which protects motor interior from dust and moisture.
- A rotating labyrinth seal which further protects the motor interior from damage by foreign matter.



**TRI CLAD**  
REG. U.S. PAT. OFF.  
**MOTORS**

## EVERYBODY'S BUSINESS

# Rivals Help Firm Get Back on Feet After Fire

BY PHIL S. HANNA.

Those who say there isn't any sentiment in business might consider what sentiment did to help a burned out West Side manufacturer hold his trade and quickly get back into production.

About 4:30 a.m. on Monday, March 3, the Accurate Spring Manufacturing Co., at 3811 W. Lake st., had a real fire. It was called a total loss. The brick walls were left standing but that was about all. All records and office equipment were destroyed with the exception of those in the vault.



PHIL S. HANNA.

The president of the company, F. D. Weber, happened to be in Florida but the vice-president and general manager, A. A. Bonde, was quickly on the job.

BY NOON OF THE DAY of the fire, with the help of the Illinois Bell Telephone Co. and the Graemere Hotel, five trunk lines were operating at the hotel on the company's regular telephoning number. Bonde and his aids were contacting customers all over the country.

Within a few hours after the fire five competitors in Chicago had volunteered to produce springs for the Accurate company. Some offered to use Accurate personnel to give the company full opportunity to meet the particular needs of its customers.

The Galter Manufacturing Co., 711 W. Lake st., one of Accurate's customers and a manufacturer of cameras and lighters, turned over floor space to Accurate for rebuilding tools and permitted Accurate personnel to use its tool-making machinery. Another manufacturer offered the use of brand-new machines.

A MEETING OF THE Chicago Association of Spring Manufacturers was called to help Accurate get back into production for it was realized how seriously the fire had endangered the close production schedules of the automobile industry, a big user of springs.

On Monday, March 10, seven days after the fire, the Accurate company set up temporary headquarters in a plant at 1474 W. Hubbard st., leased from the Nu-Tone, Inc., manufacturers of chimes. Nu-Tone was moving and Accurate took over an unexpired lease, a number of punch presses and tool room equipment.

On the 10th day after the fire contracts were placed with L. J. Graf Construction Co. to rebuild the factory at 3811 W. Lake st.

MORE THAN 150 EMPLOYEES had been called back to work. The company's branch plant at Fowler, Indiana, was doing double duty.

"Call us on our new telephone, MONroe 1145," says a letter from President Weber to his customers under date of March 12 (nine days after the fire). "It is likely we can take care of your requirements beginning April 10."

"Why all this co-operation?" I asked of a man who knows the background. "Oh," he replied, "Weber put in 15 years building good will among customers, his competitors and his own employees—and when he got into trouble everybody wanted to help him. It's a Chicago habit, I believe."

## Stocks Dr Lower on

WE would like to use this means to thank those whose cooperation made possible our prompt resumption of production following the fire which destroyed our main plant. We are again able to quote on all types of precision springs and wire forms, and in many cases can promise favorable delivery schedules. When you need springs we will welcome the opportunity to discuss your requirements with you.

**ACCURATE SPRING MFG. CO.**  
1474 W. HUBBARD STREET (Temporary)  
CHICAGO 22, ILLINOIS

ADV Union ern, T Joy M Ame most o \$200,00 on the Bethle Goodri J. I. C Chemi ley, American Can a Union "A."

PUBLIC interest still minimum with brokerag ers holding aloof becau ticism regarding the bus ture, foreign affairs, and a number of wage- tations threatening corpo its.

Professional contingen ed some buying on the the drying up of liquidat the list was in shape p rebound if given p courage ment. Earnings dends, for the most part nored.

Most bonds got now

## Stocks Recei Unlisted Tra Rights from

PHILADELPHIA — Securities and Exchange sion today approved a tion by the Detroit S change to extend unlist privileges to the foll securities:  
The \$1 par common ghany Corp., American Inc.; Niagara Hudson Po Sunray Oil Co., and Corp.

THE \$2.50 par comm American Airways Cor \$5 par common of Ster Inc., and Warner Bros. Inc., the \$10 par comm tional Biscu



Send for a copy of the Accurate "Handbook of Technical Data on Springs" which contains valuable data on design formulation and load deflection.



# Mass Lubrication for Mass Production

**POSITIVE  
LUBRICATION  
in Seconds  
with Oil or  
Grease**



**SIMPLICITY  
and Economy  
of Installation**



**SALES OFFICES  
& ENGINEERING  
SERVICE from  
Coast-to-Coast**

*Save*

**BEARINGS • MACHINE HOURS •  
MAN HOURS • POWER • and PREVENT ACCIDENTS**

In use throughout modern industry, Lincoln Centro-Matic Systems of centralized lubrication have proven to be the most efficient and economical method for "mass lubrication" of industrial machinery. Systems utilize only one lubricant supply line, insuring the most simplified and economical installation possible. Injectors connected by tubing to the bearings, will dispense either oil or grease, and operate by positive displacement. They are actuated by supply line pressure, and discharge lubricant to each bearing at the line pressure. Injectors are adjustable externally so that each bearing may receive a predetermined amount of lubricant.

Various types of lubricant pumps and injectors are available to meet specific requirements.

Cut lubrication time and cost—increase production with proven Lincoln Centro-Matic Systems.

**LINCOLN manufactures a Complete Line  
of Industrial Lubricating Equipment**

# LINCOLN

*Pioneer Builders of Engineered Lubricating Equipment*

BULLETIN No. 801

## LINCOLN CENTRO-MATIC

LUBRICATING SYSTEMS

for MASS LUBRICATION

WITH SERIES SL-3 INJECTORS

AUTOMATICALLY CONTROLLED — MANUALLY TIMED

**LINCOLN ENGINEERING COMPANY**  
5701 NATURAL BRIDGE AVE., ST. LOUIS 20, MO., U. S. A.

*Send for Your Copy of This  
New Bulletin No. 801*

*It gives full information on the newest  
developments in Centralized Lubrication.*

**Lincoln Engineering Company, St. Louis 20, Mo.**

Please give me information on Centro-Matic Systems for (type of machine) \_\_\_\_\_ Send me your new Centro-Matic Bulletin 801 ☐ Catalog on Industrial Lubricating Equipment ☐.

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AM

847-8

**Published for your information**

# **THE NEW, COMPLETE LIST OF AISI STANDARD STEELS**

The new list of the standard steels approved by the American Iron and Steel Institute as of April 16, 1947 has been published in pamphlet form by Bethlehem Steel Company.

This 8-page pamphlet gives the latest AISI numbers with the revised chemical compositions of the new standard grades including all—

STANDARD ALLOY STEELS

STANDARD CARBON STEELS

STANDARD RESULPHURIZED CARBON STEELS

If you are a materials engineer, a metallurgist, a designer, a purchasing agent—anyone who specifies or uses steel in any form—you will find this up-to-the-minute list of considerable value. Write today for your free copy of *AISI Standard Steels*.

**BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.**

*If you are located in the far West address your request to*

**BETHLEHEM PACIFIC COAST STEEL CORPORATION, SAN FRANCISCO**



# HIGHLIGHTING ANOTHER NEW CAR...

**DU PONT**

*"Lucite"* \*



- 1 Hood ornament
- 2 Steering column plaque
- 3 Clock dial
- 4 Horn button
- 5 Speedometer dial

These parts molded by Electric Autolite Company,  
Bay Manufacturing Division, Bay City, Michigan.

\*REG. U. S. PAT. OFF.

On 15 different makes of the new cars appear 58 separate parts made of Du Pont "Lucite"

The parts shown above are all to be found on one of these cars.

Manufacturers prefer "Lucite" acrylic resin for important reasons. "Lucite" adds the beauty that helps make sales. And the beauty of "Lucite" lasts. It is not dimmed by moisture, sunlight, "weathering." "Lucite" has good shatter-

resistance, good tensile and flexural strength.

"Lucite" does its many tasks supremely well. On the dashboard, the ability of "Lucite" to "edge-light" has especial value... its excellent optical properties give the driver instant answers to urgent questions.

"Lucite" is available in your choice of sparkling colors or in colorless transparency. For complete data address: E. I. du Pont

de Nemours & Co. (Inc.), Plastics Dept., Room 206, Arlington, N. J.





# Here's how to "make a hit" with the ladies



the convenience and safety of push-button

starting with

**Bendix**

**Drive**

helps win women

to your car



If you leave it to the ladies, they'll pick the car with push-button starting almost every time. And that's a smart tip for more sales for you. Both men and women appreciate the extra convenience of the handy button within easy sight and reach—eliminating the necessity of groping for hard-to-reach pedals.

The use of Bendix\* Drive in push-button starting makes possible the elimination of a great many pieces of linkage

—a most important item in saving costs. *There is no possibility of damage if the starter button is pushed while the engine is running*—a feature owners are sure to appreciate.

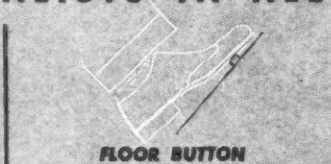
Add push-button starting to the list of outstanding sales features on your cars—but when you do, make sure it is push-button starting with Bendix Drive—for that is the simplest, most convenient, and most economical way it can be accomplished.

\*REG. U.S. PAT. OFF.

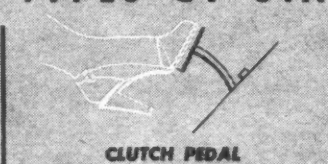
## SPECIALISTS IN ALL TYPES OF STARTING



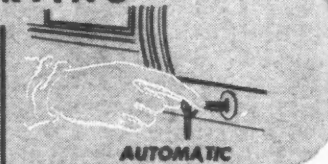
PUSH BUTTON



FLOOR BUTTON



CLUTCH PEDAL



AUTOMATIC

**Bendix Drive**

ECLIPSE MACHINE DIVISION of  
ELMIRA • NEW YORK



If you use springs . . .



# *remember*—better springs make better products.

THE technical "know-how" acquired in more than a century of manufacturing wire products . . . plus greater precision in inspection and manufacture are the reasons for the outstanding performance of U·S·S American Quality Springs.

These superior springs resist fatigue and hold their shape with unusual success. They give additional life to your product.

When you specify American you get

better springs for your product. And because our production facilities are second to none, you can usually count on speedy delivery of springs in *whatever* quantity you need.

Let our spring engineers help you select the right springs for your product. No matter what type you need, we can supply them . . . for we produce every type and size of compression, extension, torsion and flat springs in common use.

#### THE JOHN DEERE AUTOMATIC BALER

The vitally important tooth bar spring on the pick-up as well as several other springs on the press are American Quality Springs.



#### AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco,  
Pacific Coast Distributors

Tennessee Coal, Iron & Railroad Company, Birmingham,  
Southern Distributors

United States Steel Export Company, New York

#### UNITED STATES STEEL

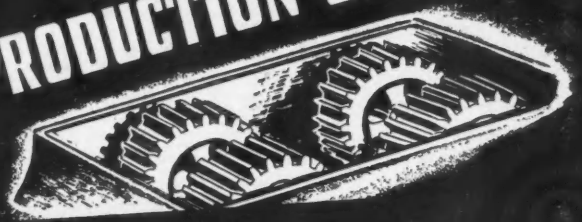


## *U·S·S American Quality Springs*

**ENGINEERED to  
YOUR SPECIFICATIONS . . .**



**GEARED to YOUR  
PRODUCTION SCHEDULE**



# *Modern* **CLEVELAND** **FOUR POINT PRESSES**

Although, in most instances, the wide range of standard sizes and capacities in which this popular line of Modern Four Point Presses can be furnished, is sufficiently large and varied to meet the needs of most Power Press users, our ability to furnish Modern Four Point Presses is not confined to standard machines and we are prepared to furnish Presses "engineered to YOUR specifications and geared to YOUR production".

Whatever you produce in the line of pressed metal products—whether large or small—you will find that the use of Modern Cleveland Single Point, Two Point or Four Point Presses will enable you to obtain greater efficiency, lower costs and more assured uniformity because Cleveland Presses are designed for accuracy of production and economy of operation.

*Why not investigate the advantages of Modern Presses "engineered to YOUR specifications and geared to YOUR production"?*

*"If it's a Cleveland—  
it's Modern"*

4-108-50D—Stroke 24", Adjustment 6"  
bed area 70" x 108", capacity 500 tons

## *District Offices*

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**THE CLEVELAND PUNCH & SHEAR WORKS CO.**

3917 ST. CLAIR AVE. CLEVELAND 14, OHIO



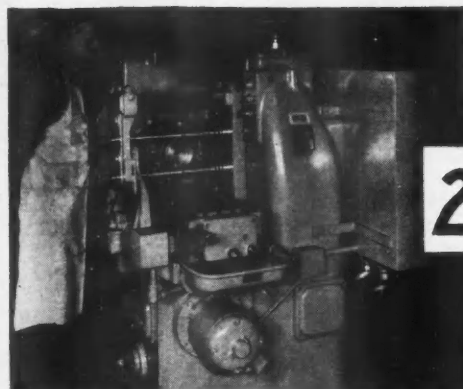


1



### Machine Time Cut from 3 Hours to 8 Minutes With STANDARD RIGIDMIL

This completely automatic Rigidmil is standard, including the vertical feed attachment. Loading and unloading the workpiece and starting the machine cycle constitutes the operator's duties. The 12 grooves in the pump cylinder block sleeve were formerly machined in 3 hours. The Sundstrand Rigidmil automatically machines the 12 grooves at the rate of 7½ pieces per hour. In addition, compared to the previous method of machining, the operator's duties are greatly simplified.

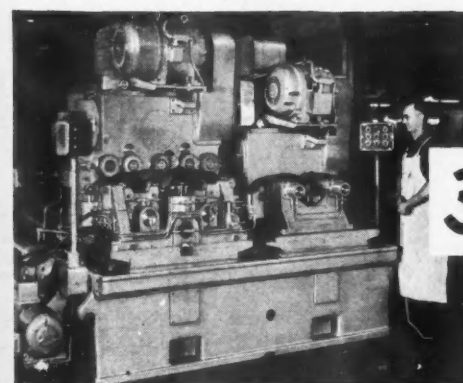


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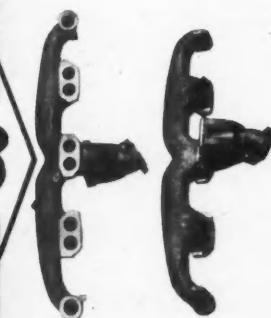


### SUNDSTRAND RIGIDMIL With Special Head Mills 84 slots in One Setting

This Standard Rigidmil has been provided with a special 2 spindle horizontal head. In addition, a special Sundstrand automatic index base is mounted to the machine table. The work holding fixture mounted to the automatic index base holds one part. The part has 84 slots — 42 in upper half and 42 in lower half. In using the automatic index in conjunction with an automatic machine cycle, all 84 slots are milled automatically with only one handling of the work piece. The cut is of the "plunge" type. Consequently the machine is equipped with a positive stop and dwell attachment so that the length of feed stroke (depth of cut) is held within limits of—.001". Three different sizes of parts are machined on this Rigidmil.



3



### SPECIAL RIGIDMIL Mills 11 Surfaces in 2 Settings

The shape of the part together with production requirements called for a special machine to mill these manifolds. Operations include rough and finish milling port faces and back facing washer seats on port flanges. The special Sundstrand Twinplex Rigidmil has a ten spindle head on left hand column, for rough and finish milling the five port faces — the six spindle head on the right hand column mills the seats on the port flanges. The manifold is transferred from left to right with the operator loading at one station while a part is being machined in the adjoining station. The fixture at the left hand station is automatically retracted on the return stroke of the head so that the cutters do not drag over finished milled surface.

# How SUNDSTRAND "Engineered Production"

## Improves Milling Methods

Profitable milling production can be obtained only by lowering unit production costs . . . obtaining the most economical solution to your milling problem and the most productive milling equipment in relation to your production requirements.

Basically, there are two approaches to solving these problems, (1) obtaining standard machines, then trying to process parts over these machines as economically as possible, (2) designing the most profitable processing method, then obtaining machines to suit this method — standard or semi-standard machines, if possible, or entirely special machines, if necessary.

This latter method is Sundstrand "Engineered production" . . . the most practical approach to economical milling. The following is a brief resume of the complete engineering and manufacturing service available from Sundstrand to meet all or any of your production milling requirements in small and medium size work.

These actual examples are presented to reveal one of each of the methods used in solving milling production problems. One of these methods may be the solution to your present problem.

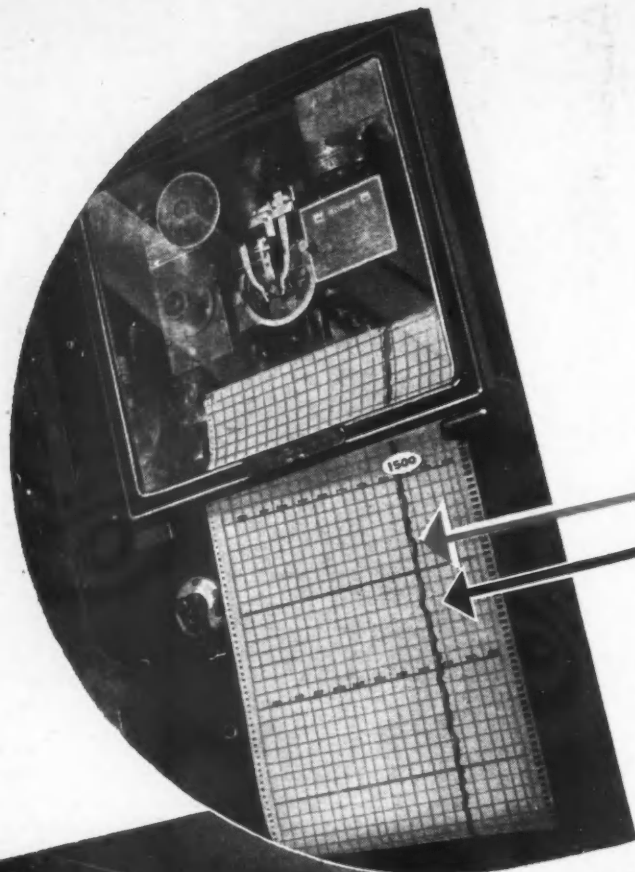
**FREE ADDITIONAL DATA** Write for more proof of the successful application of Sundstrand "Engineered" milling production. Our Booklet entitled "Practical Milling Methods" contains over 60 problem solutions complete with tooling diagrams. Ask for Bulletin 261.



## SUNDSTRAND MACHINE TOOL COMPANY

2571 Eleventh St. • Rockford, Ill., U.S.A.

RIGIDMILS • AUTOMATIC LATHES • SPECIAL MILLING AND TURNING MACHINES



**too HOT**  
**at 1505°**

**too COLD**  
**at 1495°**

**...but Temperatures are held JUST RIGHT  
in heat treating PERMITE Steel Parts**



Precision control in the heat treating department is a major factor in giving you the exact physical properties you want in your Permitte Steel Parts. Permitte heat treating furnaces are controlled to  $\pm 5^\circ$  F. on all predetermined temperature ranges for the proper heat treating of the particular steel or part. This same exactness of control extends to temperature time, atmosphere and quench media in Permitte heat treating operations.

A Permitte piston pin, bolt, bushing, shaft or other steel part is a superior part because of the quality control exercised in every step of its manufacture. This quality control safeguards the Permitte reputation for dependable performance in all types of automotive, aircraft and industrial applications. Ask for full information on Permitte precision-made steel parts, and Permitte facilities for serving you.



**PERMITE**

**ALUMINUM INDUSTRIES, INC.**

CINCINNATI 25, OHIO

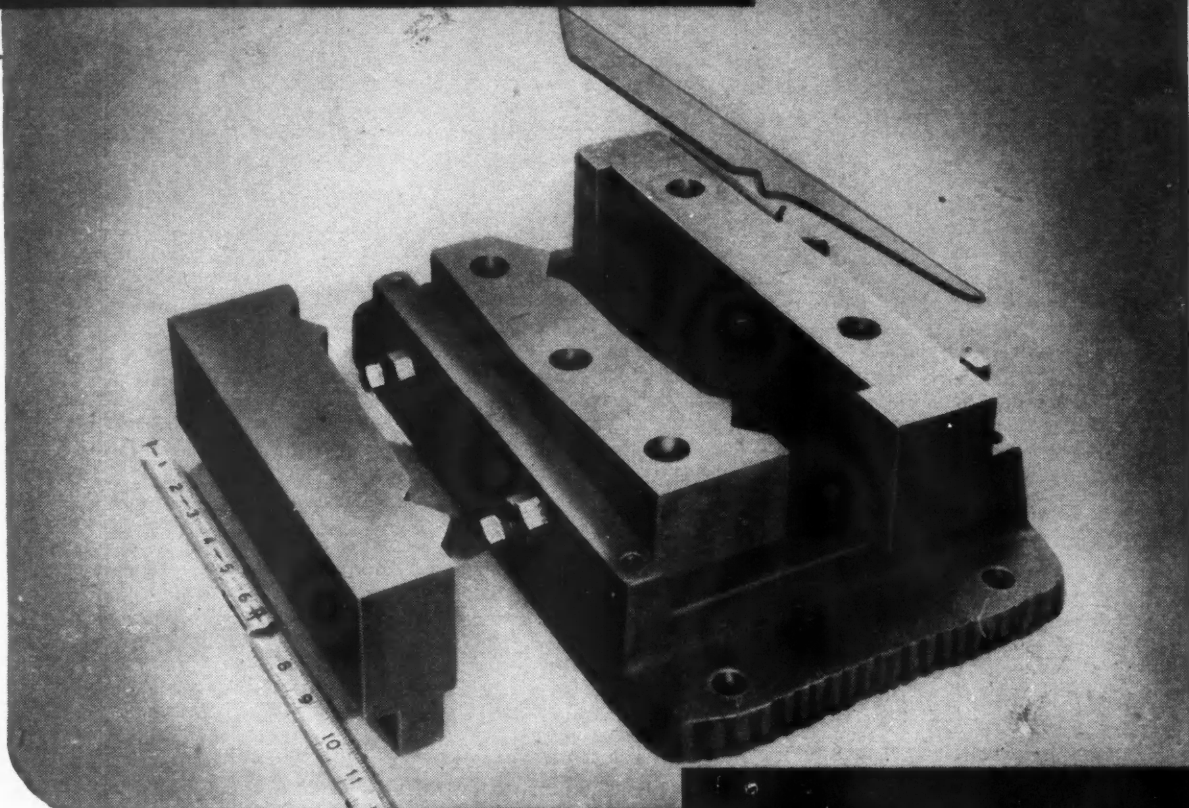
DETROIT: 809 New Center Building. NEW YORK: 9 Rockefeller Plaza. CHICAGO: 44 E. Jackson Boulevard. ATLANTA: 413 Grant Building

ALUMINUM PERMANENT MOLD, SAND and DIE CASTINGS...HARDENED, GROUND and FORGED STEEL PARTS

# ***DISSTON***

## **NICROMAN TOOL STEEL**

### **MIX 827**



• Nicroman Stripping Shear, used for cutting high carbon hedge shear stock. In use for one and one-half years and still going strong. Carbon Steel Shear formerly used ran only 4 to 6 months.

**NOTED FOR UNUSUAL TOUGHNESS AND  
RESISTANCE TO TRANSVERSE STRESS**

Nicroman comes as close to being an "all purpose" steel as any other tool steel made. Many users have adopted it as standard for all their tools except those requiring high speed steel. The result is a saving in inventory stocks, avoidance of misuse of a brand, simplification in heat treating and better tool performance.

The success of Nicroman is due to many factors:

- ... Non-deforming qualities of an oil hardening steel.
- ... Long wearing characteristics of a chromium alloy.
- ... Toughness imparted by addition of nickel.
- ... Dependability in heat treatment resulting from low hardening temperature and mild oil quench.
- ... Resistance to edge-spalling.

All combine to make Nicroman a serviceable, dependable tool steel that can be used to advantage for hobs, punches, shear blades, spindles, hammers, machine parts, dies and many other tools.

**HENRY DISSTON & SONS, INC., 631 Tacony, Philadelphia 35, Pa., U. S. A.**

#### **ANALYSIS**

Carbon	.70%	Nickel	1.65%
Manganese	.40%	Chromium	1.00%
Silicon	.20%	Copper	.35%



**DISSTON ENGINEERS WILL BE GLAD  
TO HELP YOU FIND THE SOLUTION TO  
ANY OF YOUR TOOL STEEL PROBLEMS**

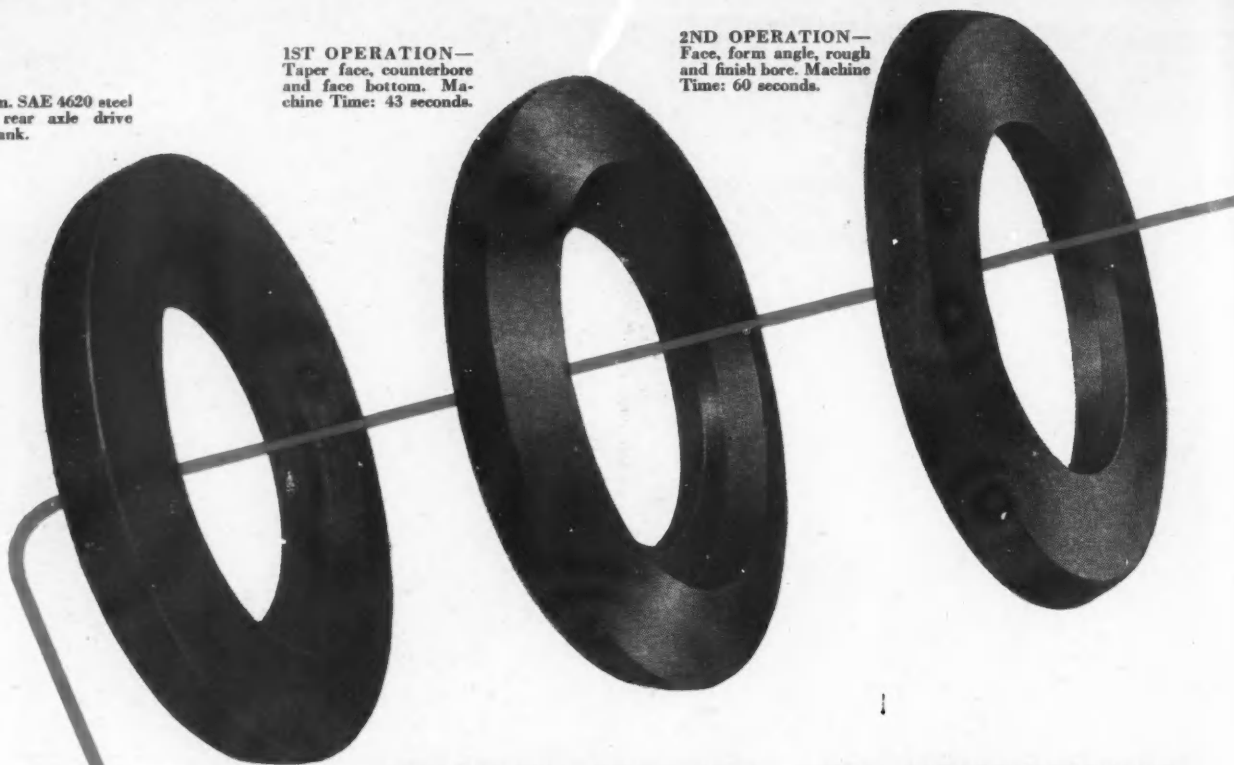
**STEEL**—Everybody who wants to obtain steel can help himself to get it by immediately starting scrap into the channels that serve steel mills.



3" Diam. SAE 4620 steel  
forged rear axle drive  
gear blank.

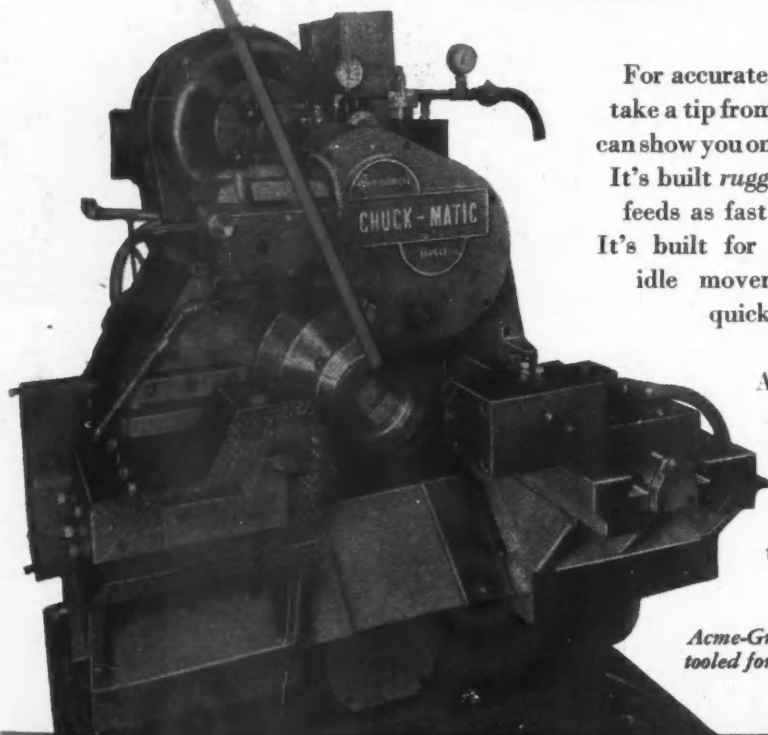
1ST OPERATION—  
Taper face, counterbore  
and face bottom. Ma-  
chine Time: 43 seconds.

2ND OPERATION—  
Face, form angle, rough  
and finish bore. Machine  
Time: 60 seconds.



## CHUCK-MATIC PRODUCTION

Two Operations—1 Min. 43 Sec.—Complete



For accurate, high-speed production of chucking jobs take a tip from this typical case study—one of many we can show you on the new Acme-Gridley 12" Chuck-Matic. It's built *rugged*—and *powerful*—to deliver speeds and feeds as fast as carbide-tipped tools can take it.

It's built for *high production*—with a minimum of idle movement and plenty of accessibility for quick setups, easy loading, easy adjustment.

It's built *compact*—for space saving. And because it's *easy to operate*, one operator (he needn't be highly skilled, either) can run as many as four machines.

That's why we think you'll be interested in the complete details on the Chuck-Matic. Ask for bulletin SC-46.

*Acme-Gridley 12" Single Spindle Chuck-Matic  
tooled for first operation on rear axle drive gear.*

# The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

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**DEMONSTRATED**  
Booth 628  
Machine Tool Show  
CHICAGO—SEPT. 17-26



Bakeries, breweries, meat packers, dairies, moving companies and others are now using truck panel bodies of Revere Magnesium Alloys to lower their transportation costs.

## Magnesium puts money in the bank

PENNIES in the bank instead of being wasted out of the exhaust—such is one benefit brought to truck operators by bodies made of Revere Magnesium Alloys. This lightest of all commercial metals lessens deadload. The Purity Baking Company reduced truck weight by 1240 pounds in this way, resulting in savings in gasoline, oil, tires, general chassis wear. When this entire fleet has been equipped with magnesium bodies the reduction in fuel costs alone should amount to \$1,000 a month. Another company, a large grocery chain, takes advantage of magnesium's lightness in a different but equally valuable way. The weight taken off the body is added to the payload.

If you operate vehicles for highway or air transportation, the light weight and high strength-weight ratio of Revere magnesium alloys can help you save gas, oil, tires and other operating expenses or enable you to carry additional payload. With Revere sheets and standard shapes, any body

builder can produce truck panel bodies of magnesium alloys easily and quickly. Readily available for prompt shipment, these Revere materials can be assembled into bodies by means of the simplest fabricating methods.

For further information on Revere magnesium alloys and their ability to save money for you, get in touch with the nearest Revere office.

# REVERE

**COPPER AND BRASS INCORPORATED**

*Founded by Paul Revere in 1801*

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities.



## Softens Some of the Hardest Problems!

One process makes a finished felt soft and fluffy as a summer cloud. Another makes it tougher than a fifty-cent steak. And still others can give felt varying specified degrees of hardness — or softness — in the wide range between.

Cut felts do not ravel, shred or fray. Ordinarily, they're ready for assembly when shaped by a single, elementary operation.

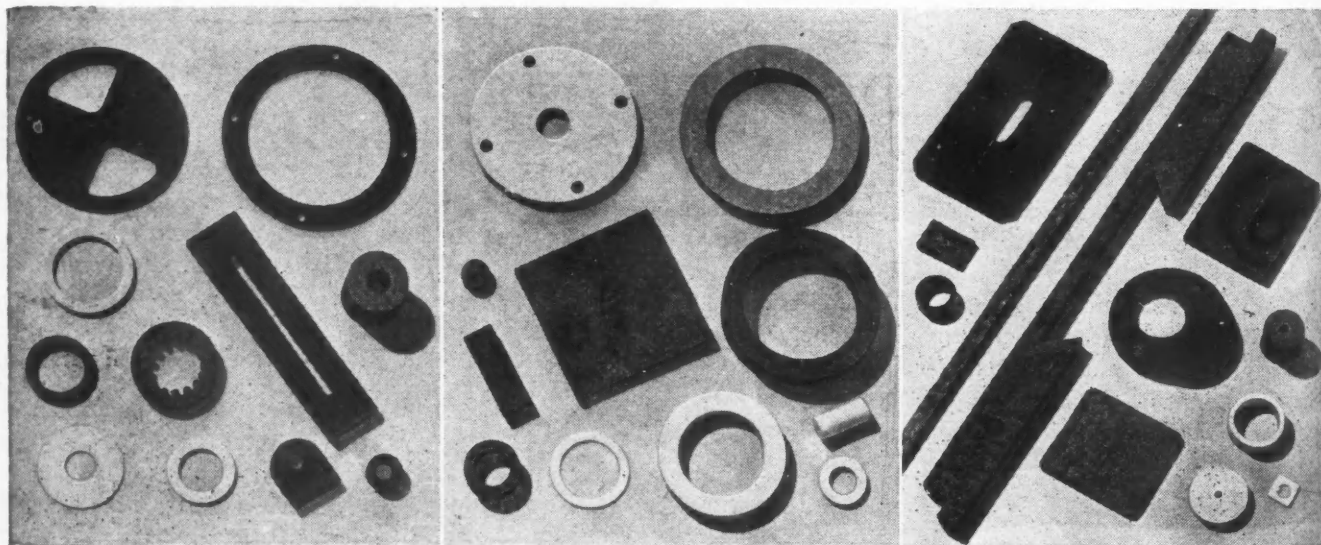
Felt is rugged and lasting — not harmed by sun, moisture, heat or cold — ageless — can be used freely exposed to oil and gasoline.

It can be punched and chiseled, turned and

scarfed, die-punched and skived, ground or otherwise tooled by simple and common methods.

**REMEMBER** — The Felters Company *makes* the felt for the parts it cuts. The advantage to you of this start-to-finish supervision is reflected in the quality, uniformity and accuracy of every part that leaves The Felters Company mills.

To assist you in ordering parts with sure, quick ease, we've prepared the Felters Precision Cut Felt Parts Manual. You can have your copy simply by dropping us a card, so do it — *now!*



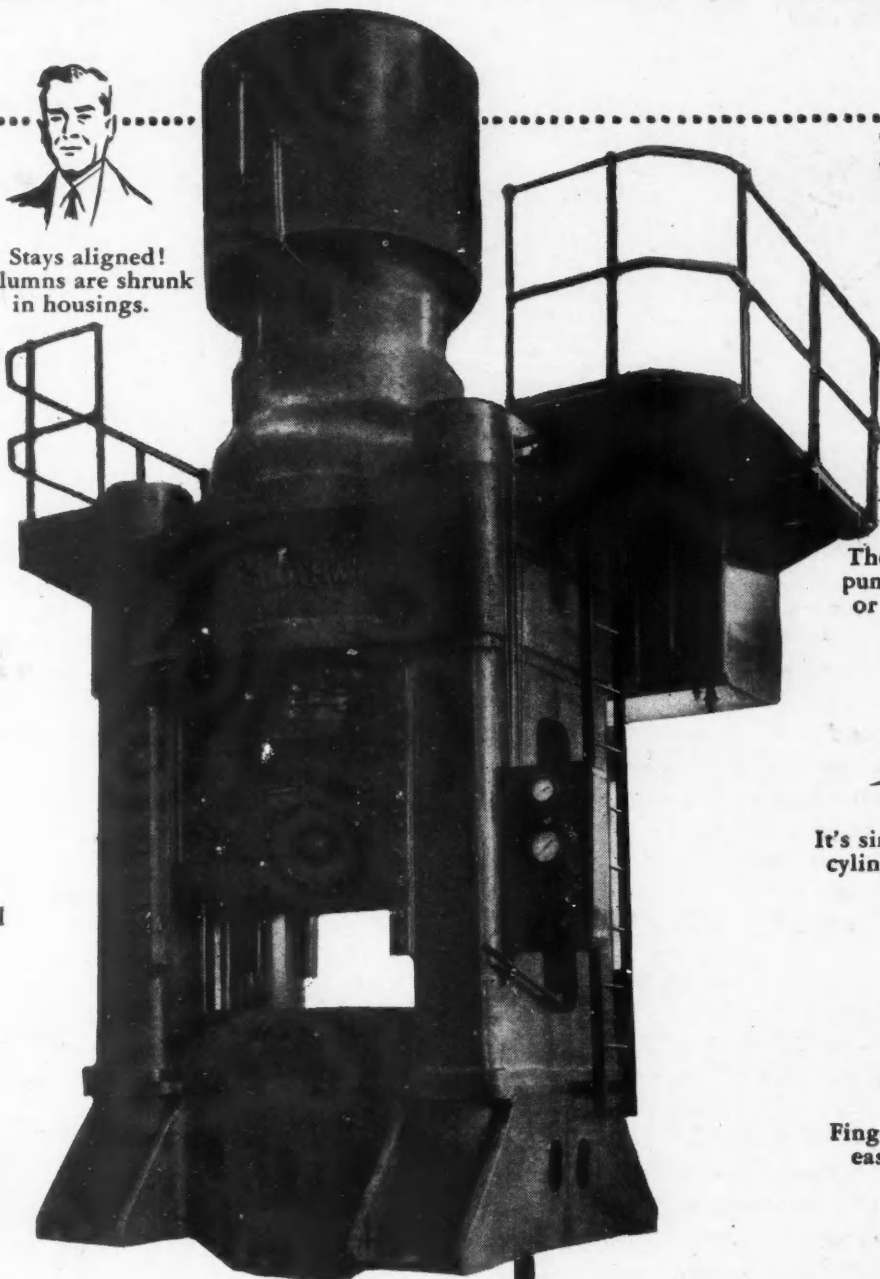
## THE FELTERS COMPANY

210-R SOUTH STREET, BOSTON 11, MASSACHUSETTS

Offices: New York, Philadelphia, Chicago, Detroit • Sales Representatives: San Francisco, St. Louis  
Southern Representative: Industrial Supply Co., Clinton, S. C. • Mills: Johnson City, New York;  
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Those high capacity tanks are good...



Stays aligned! Columns are shrunk in housings.



High Production! That's what we need!



Saves power—main cylinder fills on idle stroke.



Those radial piston pumps give pressure or volume needed.



It's wear-proofed. Bronze cylinder and gland bushings!



It's simple to service—cylinders are outside packed!



Those die cushions are easy to adapt for stripping!



Fingertip control—easy to operate.



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That hand control handles inching or die setting.

Designed to meet today's production needs, and engineered by one of the oldest and largest press manufacturers, Baldwin Southwark Hydraulic presses have something extra to offer you in the way of appealing features. Experience gained in producing all types of metal presses provides the right answers, right away, to your individual problems. The Baldwin Locomotive Works, Philadelphia 42, Pa., U. S. A. Offices: Philadelphia, New York, Boston, Norfolk, Birmingham, Houston, St. Louis, Chicago, Cleveland, Detroit, San Francisco, Washington, Pittsburgh, Seattle.



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**HYDRAULIC PRESSES**

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Utility and Work  
Clothes!

## "FROM COTTON TO CUTTER"

SMART looking uniforms of durable Reeves Army Twill can do an important selling job in the contacts your employees make with the public. The high tensile strength of this fabric assures rugged wearability. Its vat dyed colors are fast to sun, water and perspiration. Sanforized Shrunk\*, it retains smart tailoring. Remember—over 90 million yards of this same cotton fabric was used by America's fighting forces—exceeding Government specifications under the toughest combat conditions.

*\*Residual shrinkage less than 1%.*

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# Tough Tools for Tough Jobs



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The superior quality and rugged durability of Herbrand Tools are the result of over 65 years of research, engineering and development. For years they have been known as the toughest tools for the toughest jobs—designed to raise the efficiency of the worker to the highest degree. For details on complete line, request a copy of catalog No. 53.

**THE HERBRAND CORPORATION**  
Fremont, Ohio





**BE SAFE . . . on the Down Grades—  
in Heavy Traffic—and on the Straightaway!**



**with MIDLAND Power Brakes**

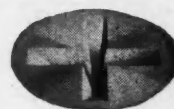
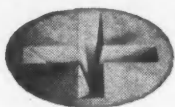
Designed and engineered for greater safety and more dependable service under all operating conditions. Ruggedly constructed — offer more positive control — easy to install — interchangeable in fleet operation. Economical.

Available in complete kits, all ready to install, for trucks and truck and trailer outfits. Air or vacuum.

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THE POINT IS ALWAYS

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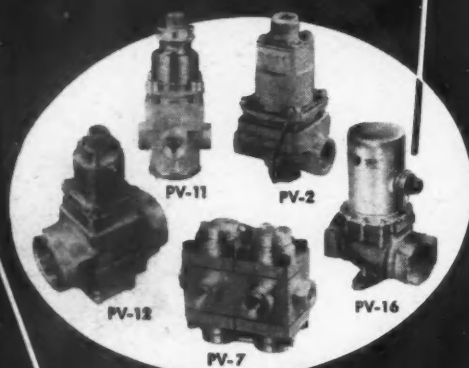
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*in the Spotlight!*



## Unsurpassed *hi-g*\* Valves for Portable and Aircraft Applications

\*Trademark—"hi-g"— indicates positive operation in any position, regardless of vibration, change of motion or acceleration. Specially designed for portable use— for anything that rolls, floats or flies; and for severe service, such as machine tool control. These fastest known operators embody exclusive design and structural features which provide infinitely longer service. Used on mobile equipment, such as: busses, tractors, trucks, cars, ships, aircraft and railway equipment; also on hydraulic applications, machine tools, gasoline fired heaters, diesel and internal combustion engines. They control air, gas, oil, steam, sulphur dioxide, methyl chloride, freon, water, brine, anti-icing fluids, alcohols, fluid greases, gasoline, gasoline vapor mixes and other fluids. For complete specifications, request new Catalog 52-C from nearest Factory Branch, or write direct to Factory.

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34-2

# Spring Troubles?

## ... want Dependable, Complete UNUSUAL SPRING SERVICE?

At LEWIS you will find . . .

- . . . spring engineering assistance
  - . . . precision manufacturing
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- Yours for the Asking**

Just send us specifications and let us quote on your spring or wireform job . . . or tell us your spring problem and we will help you with our specialized experience to assure you of getting the RIGHT springs at the lowest cost with highest quality for your products.

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Ask to see a Lewis Representative for Prompt, Unusual Service

**Lewis**  
PRECISION  
**SPRINGS**

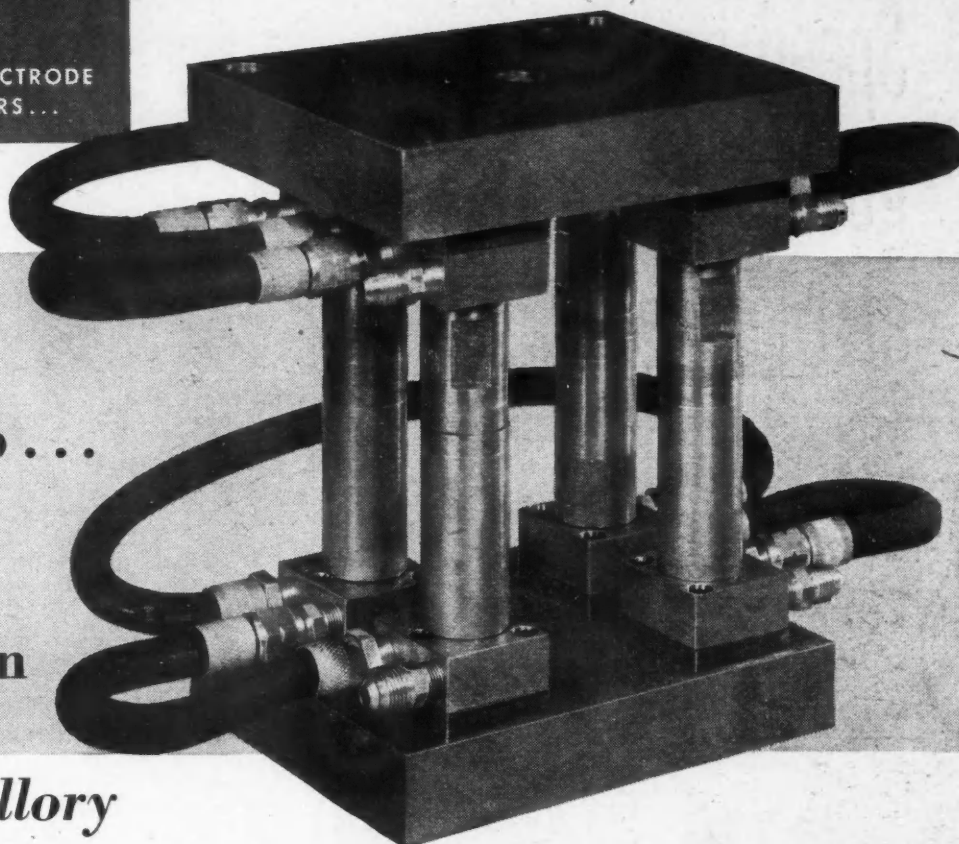
THE FINEST LIGHT SPRINGS AND WIREFORMS OF EVERY TYPE AND MATERIAL



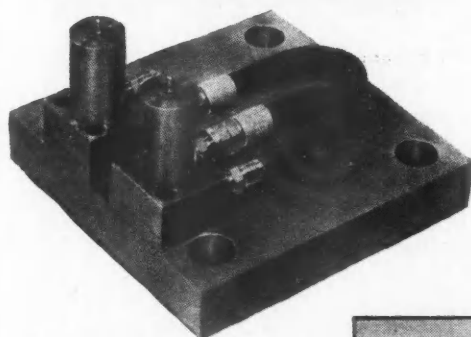
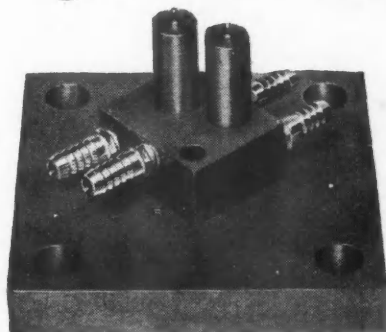


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RESISTANCE  
WELDING ELECTRODE  
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They do  
a better job ...  
and they  
cost less in  
the long run



... when Mallory  
designs and builds your projection welding dies



When Mallory builds a special die for you, we make it with standard parts wherever possible—parts such as the standard stock, Elkonite\*-faced electrodes shown in the dies pictured. This means delivery in the shortest possible time, easy and quick replacements—with a saving of money, too, by eliminating expensive specials.

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Economy, efficiency, expediency—that's what Mallory offers in building projection welding dies. Our skill and know-how are available to solve your problems.

*\*Reg. U. S. Pat. Off.*

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RESISTANCE WELDING ELECTRODES

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# Speed and Precision go hand in hand at Merz



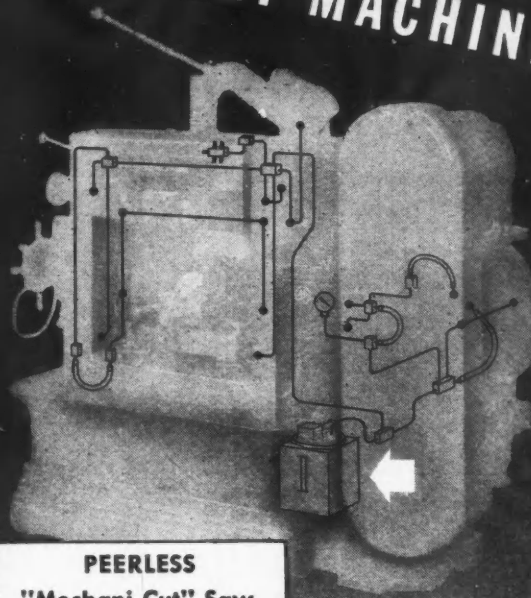
**Merz Produced these large,  
intricate fixtures in Just 10 Weeks!**

If yours is a problem of obtaining high-precision fixtures or tools—in *minimum time*—here's news! MERZ produced these six intricate drill jigs for horizontal Natco set-ups—complete with patterns, equipment and castings—in *just 10 weeks*. What's more important, these jigs were built to the highest precision standards for drilling, reaming and counter-boring cylinder blocks and drilling and counter-boring an oil pan. This is a typical example of the fast, accurate work being done daily at MERZ—*where speed and precision go hand in hand*. MERZ designs and produces standard A.G.D. and special gages, tools, dies and experimental machines. Write for full information today.

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SOON ON NEW MERZ AIR GAGES!**

**MERZ** *Engineering Company*  
INDIANAPOLIS 7, INDIANA

## A BIJUR SYSTEM FOR EVERY MACHINE



**PEERLESS  
"Mechani-Cut" Saw  
Automatic Lubrication by  
BIJUR**

### **how it works**

Driven by the machine, a lubricator (arrow) discharges 60 drops of filtered oil every 4 minutes... oil is instantly force-fed thru a line of branched tubing to 22 heavy-duty ways and bearings... a meter-unit at each bearing apportions the required clean oil-film to the moving part automatically.

### **what it can do for you**

A Bijur system increases production by eliminating down-time for oiling... cuts maintenance costs by reducing bearing wear... protects investment by lengthening effective machine life. It has done these things for the leading manufacturers of machine tools, printing presses and business machines. It can do the same for you.

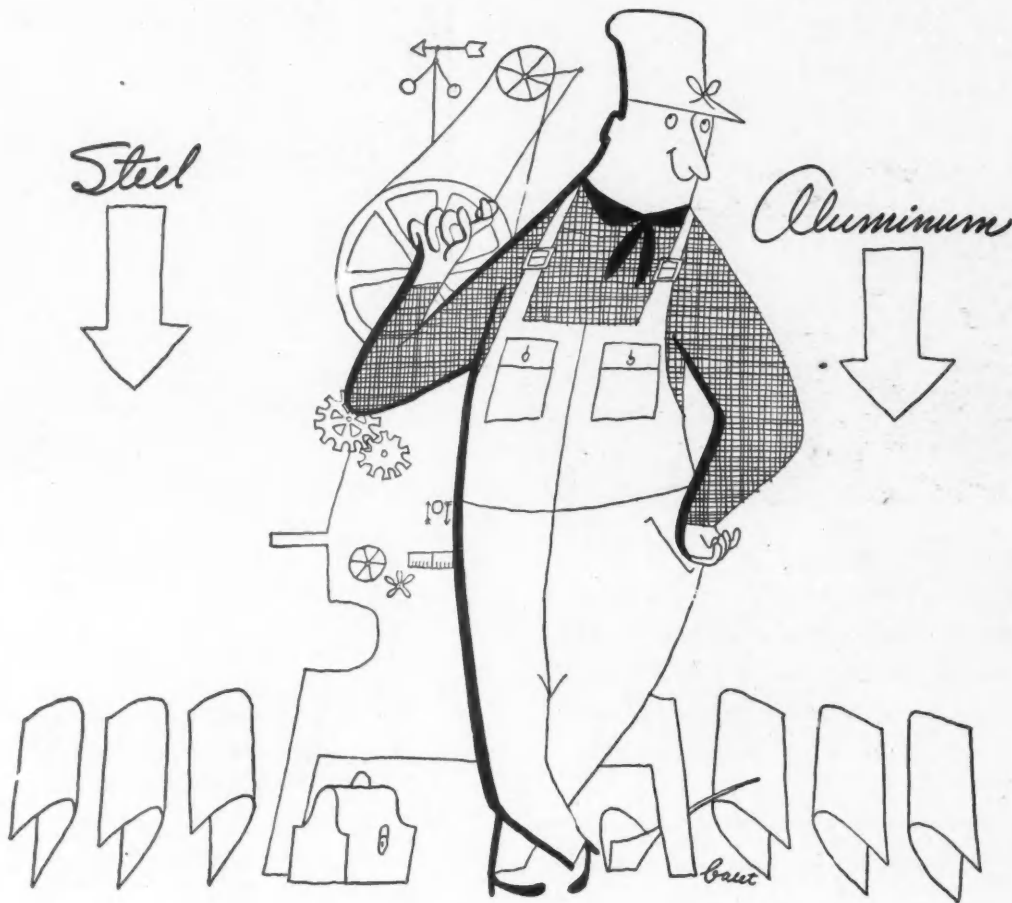
For further details, write for Bulletin 4A

2399

**Bijur Lubricating Corporation**

43-13 22nd Street  
Long Island City 1, N. Y.

**ALUMINUM** weighs only one third as much as steel



**ALUMINUM** can be drawn  
with the same dies  
you now use for steel.



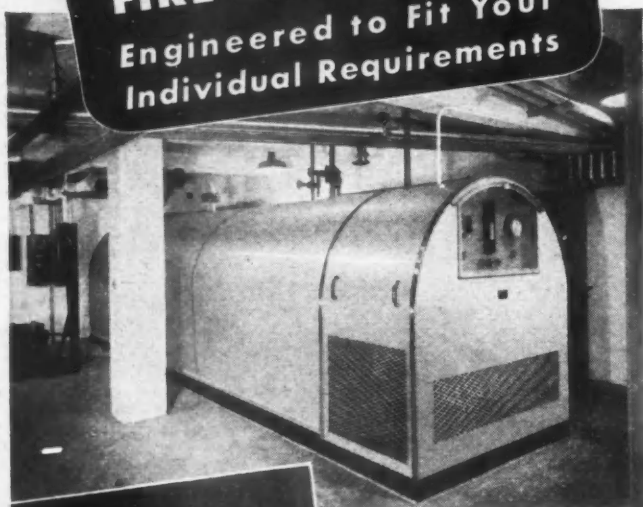
**REYNOLDS METALS COMPANY, 2513 S. 9th St., Louisville 1, Ky.**

Detroit address: 1010 Fisher Building



# CARDOX FIRE PROTECTION

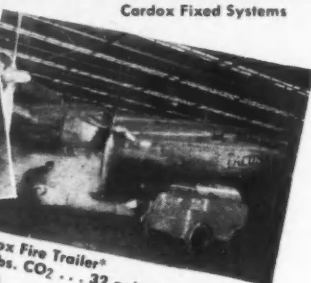
Engineered to Fit Your  
Individual Requirements



Cardox Fixed Systems



Cardox Transitan\*  
750 lbs. CO<sub>2</sub>



Cardox Fire Trailer\*  
750 lbs. CO<sub>2</sub> ... 32 gal. Foam solution



Cardox Airport Fire Truck



Cardox Fire Truck

Cardox engineered applications of low-pressure carbon dioxide give this fast-acting, non-damaging medium new effectiveness in conquering fires, large or small, both indoors and out.

Whether the hazard or combination of hazards calls for 500 pounds or 125 tons of Cardox CO<sub>2</sub>, a single Cardox System . . . with its compactly designed, centrally located Storage Unit—can be engineered to meet the specialized or varied fire problems involved. Cardox Mobile Units for indoor or outdoor protection put wheels under 750 pounds to 3 or more tons of carbon dioxide for instant use in any part of the property.

Utilized individually or in planned combinations, Cardox Fixed Systems and Mobile Units have given new scope to all the recognized advantages of CO<sub>2</sub> fire protection. Write for Bulletin 467 and recommendations for Cardox engineered protection for the tough fire hazards that worry you.

\*Now available in many localities

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CO<sub>2</sub> FIRE EXTINGUISHING SYSTEMS

# The CECOLDROP will deliver at least 10% more blows in a given time than an equal size Board Drop Hammer

**CHAMBERSBURG**

Builders of **IMPACT** Machinery

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CHAMBERSBURG ENGINEERING CO. • CHAMBERSBURG, PA.



*Tops in 1879...*

Still The Leader For 68 Years



**HARGRAVE  
CLAMPS**



New Hargrave  
Carriage Clamp.

When a line of tools leads the field in sales to industry for close to three-quarters of a century, there must be good reasons for it. And here they are:

1. Constant improvement since 1879 with the aid of skilled mechanics from noted firms. 2. There is a Hargrave Clamp for every application. 3. A progressive manufacturing policy ever alert to new ideas and developments.

WRITE FOR CATALOG showing the complete line of Hargrave Clamps—from 3/4 in. to 10 ft. openings, from 1/2 in. to 16 in. deep; also Chisels, Punches, File Cleaners, Washer Cutters, Brace Wrenches, etc.

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*The* **CINCINNATI TOOL CO.**

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THE ROSS WAY IS THE NEW WAY

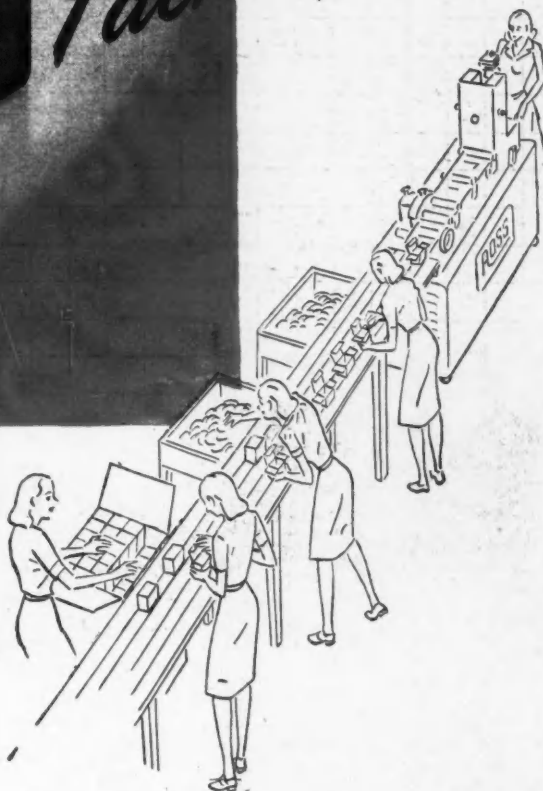


*to Speed  
your  
Packaging*

## ROSS SEMI-AUTOMATIC CARTONING MACHINE . .

. . . designed for speedier, more efficient cartoning of Automobile Parts, Airplane Parts, Small Hardware Parts (bolts, washers, nuts, etc.), where it is not feasible to handle them on the fully automatic machine.

We illustrate a typical usage of the ROSS Semi Automatic Cartoning Machine tied in with conveyor belt. It sets up tuck type folding cartons tucking one end, discharging same, ready for hand loading. This promotes a more orderly procedure for efficient pack-



aging along a conveyor line. Girls insert units and close the cartons, which are then ready to be packed in the usual shipping case.

Send us your problem. Our Engineering Staff will be glad to give you complete information. Mail attached coupon.



**A.H. ROSS**  
Co. Inc.  
PACKAGING MACHINERY - LUDLOW, KY.

7

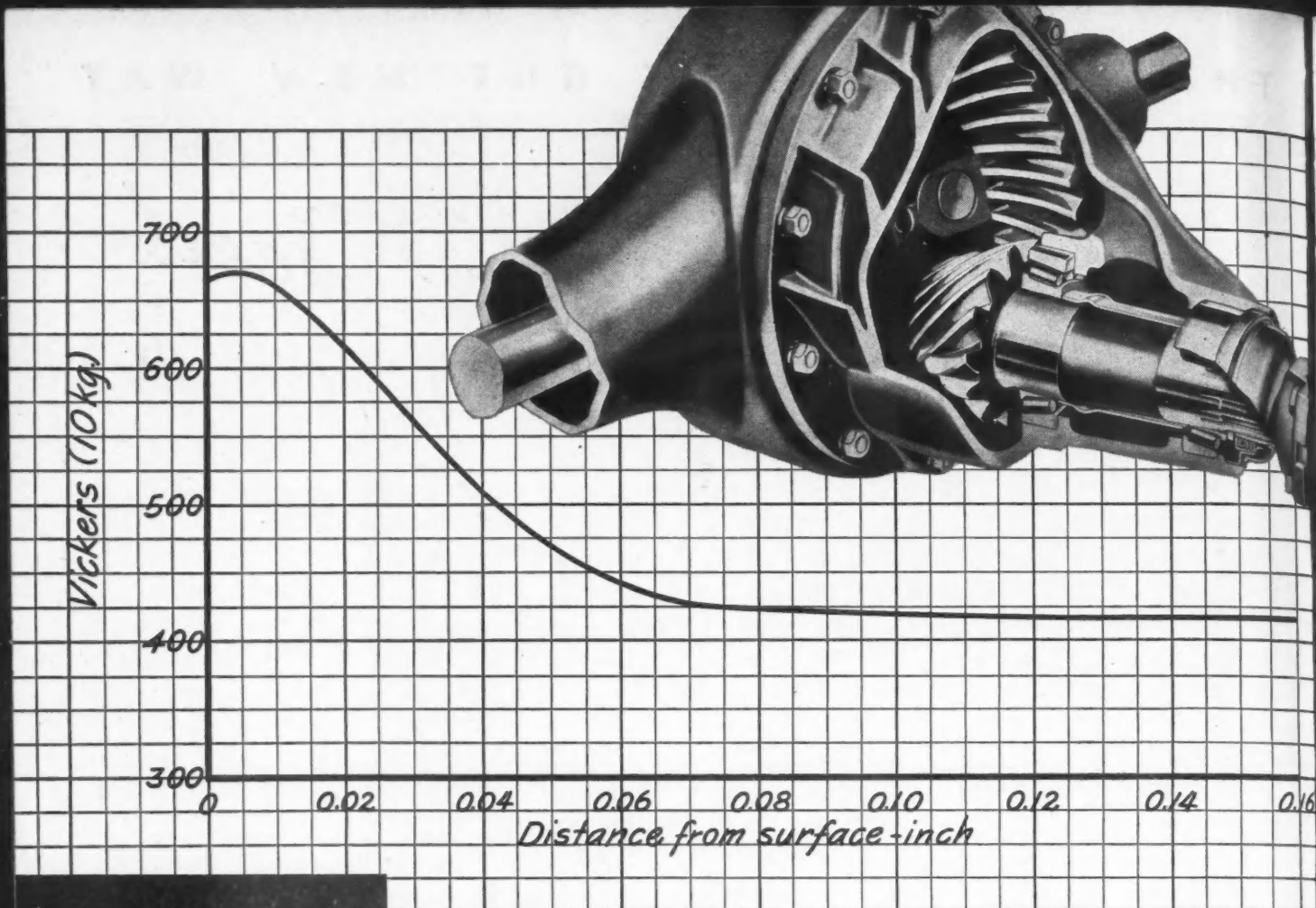
A. H. Ross Co., Inc., Ludlow, Ky.

Gentlemen: Please send me without obligation, Catalog and Data on ROSS Automatic and Semi-automatic Cartoning Machines.

COMPANY \_\_\_\_\_

NAME \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_



## BONDED FOR LONGER LIFE

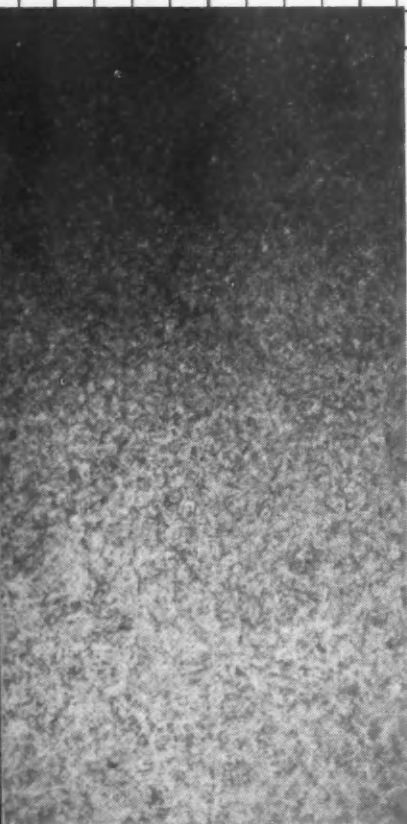
The secret of the outstanding strength of carburized parts made of Chromium-Vanadium A 6120 steel is revealed in the above chart. The noteworthy feature is the even slope of the curve, representing the *gradual* decrease in carbon penetration.

There is no sharp dividing line between the case and core—no shell to be shattered by shock or repeated stress. On the contrary, Chromium-Vanadium A 6120 carburizing steel is notable for the firm, well-integrated bond which results from the characteristically uniform decrease in hardness penetration from case to core.

The accompanying photomicrograph is further convincing proof of this exceptional integration or bonding.

For such vital parts as gears, cams, splines, shafts and bearings, the use of A 6120 Chromium-Vanadium carburizing steel assures superior performance and longer service life, in addition to over-all economy.

Our metallurgists will be glad to work with you on your carburizing problems.



Photomicrograph (100x) and hardness penetration graph of Chromium-Vanadium A 6120 steel, with a light case (0.80-0.85% carbon) in outer .010 inch.

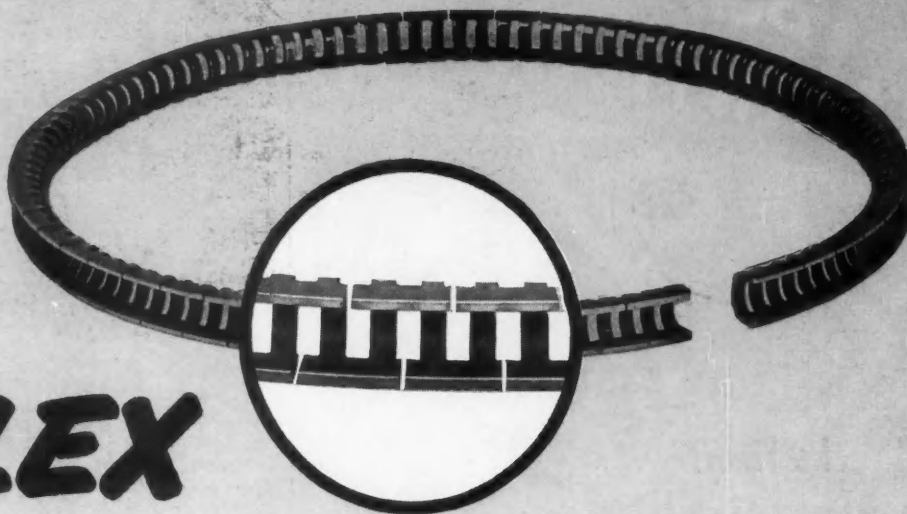
# VANADIUM CORPORATION OF AMERICA

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**The most outstanding piston ring development in 20 years...**

## The New **U-FLEX** Oil Control Piston Ring



An extremely flexible, one-piece, heat-treated carbon steel piston ring, the U-FLEX sets new standards of oil economy and cylinder lubricating efficiency. The U-FLEX provides live spring action for equalized pressures at all points of cylinder wall without the use of an inner ring.

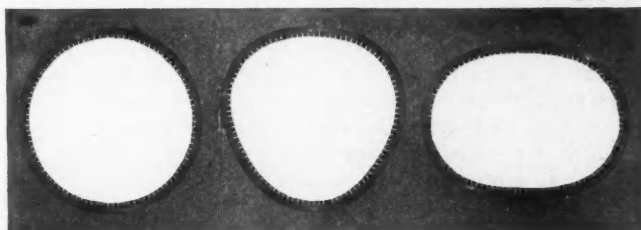
**N**EW, RADICALLY DIFFERENT DESIGN gives the U-FLEX flexibility and resiliency never before seen in a piston ring. With the U-FLEX, radial pressure against cylinder walls is uniform, constant. Oil is metered through many fine gaps in the ring in even, parallel tracks.

This steady, controlled distribution of oil means minimum bore and ring wear—with improved performance and oil economy.

Exhaustive dynamometer and road tests in many makes of engines have proved the U-FLEX superior, even in bores worn to .020" oversize. The U-FLEX has been adopted by three large engine

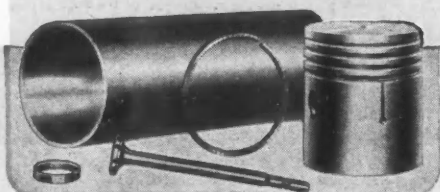
builders—is being tested by a number of others.

In many applications we believe that the U-FLEX, because of its high oil control efficiency, will take the place of two conventional oil rings in automotive engines.



**UNIFORM WALL PRESSURE** is maintained by the U-FLEX through its flexible live-spring action, not only in true cylinders, but in out-of-round or taper-worn bores as well. This extreme flexibility is demonstrated by the U-FLEX rings set in the fixture pictured above.

*Thompson improvements in precision parts engineering include Steel-Belted Pistons, U-Flex Oil Control Rings, Cylinder Sleeves, Valve Seat Inserts, Sodium-Cooled Valves.*



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# Bendix- SCINTILLA

The Finest  
Electrical  
Connectors

Money can build  
or buy!



## AND THE SECRET IS SCINFLEX!

Bendix-Scintilla\* Electrical Connectors are precision-built to render reliable peak efficiency—day-in and day-out even under difficult operating conditions. The use of Scinflex—a new Bendix-Scintilla developed dielectric material—makes them vibration-proof, moisture-proof, pressure-tight, and materially increases flashover and creepage distances. Even under extremes of temperature—from  $-67^{\circ}\text{F.}$  to  $+300^{\circ}\text{F.}$ —their performance is remarkable. Dielectric strength is never less than 300 volts per mil.

The contacts, made of the finest materials, carry maximum currents with the lowest voltage drop known to the industry. Check the list of outstanding features below—then write for detailed information on these truly superior connectors. They belong on every job where there is no compromise with quality.

\*TRADEMARK

- Vibration-proof
- Moisture-proof
- Radio Quiet
- Single-piece Inserts
- No Temporary Overloads

- Pressure-tight
- Minimum Weight
- High Arc Resistance
- Easy Assembly and Disassembly
- Low Electrical Resistance

SCINTILLA MAGNETO DIVISION of  
SIDNEY, NEW YORK



**CECO-DROP**  
makes  
other  
gravity drop  
hammers  
obsolete



**CHAMBERSBURG**  
Builders of **IMPACT** Machinery

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**... the stopping place  
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In the Heart of Pittsburgh's Golden Triangle . . . within easy walking distance of all important office buildings, stores and theatres . . . the Pittsburgher is the ideal spot to stay.

You'll enjoy the large comfortable rooms, every one with a private bath and radio . . . the excellent restaurants . . . and the friendly courtesy that always awaits you at the Pittsburgher

**Single Rooms: \$3.50 to \$5.00**  
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**A KNOTT HOTEL—Joseph F. Duddy, Manager**



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**Millions of pounds of metal  
produced by Bohn are used  
in the construction of sky-  
scrapers throughout America.**

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**"SURROUNDS" PROBLEMS IN RUBBER**



**We invite your inquiries on specific problems**

*THE DUNLOP RUBBER COMPANY*

## *Orco-operation*

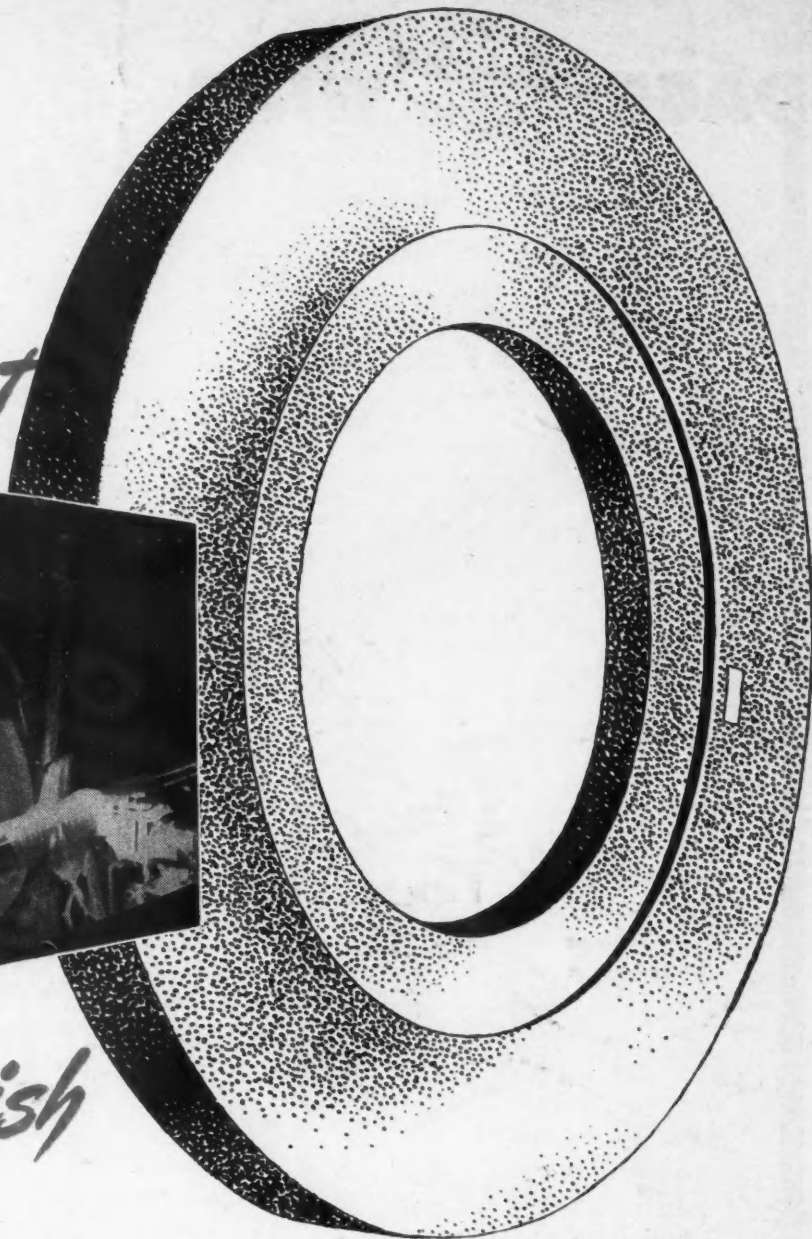
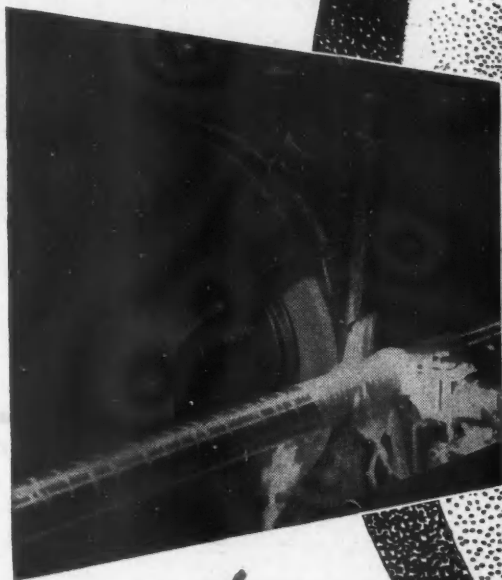
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Make a  
*selective start*

for a  
*precision finish*



Selection of the right wheel is a must for low cost, top quality precision results in cylindrical grinding. Get off to the right start by selecting yours from Simonds Abrasive's complete line. Whether for traverse, plunge cut, form or centerless cylindrical work, you can select the right Simonds Abrasive wheel to produce superior finish within the closest tolerances. For lasting efficiency of action and fewer wheel dressings Borolon Vitrified Bonded wheels are especially recommended. Simonds Abrasive Data Book is packed with information to facilitate your selection of the right wheels for your particular jobs. Send for your copy today.

For assistance in requisitioning consult Simonds Abrasive Distributors located in all principal cities.

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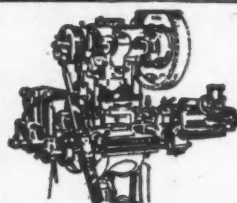
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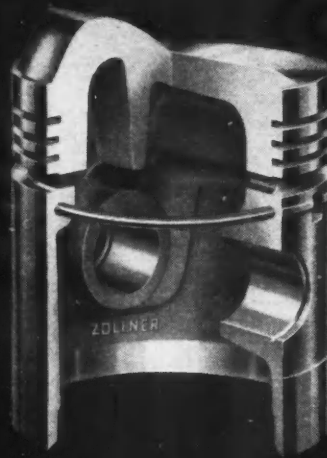


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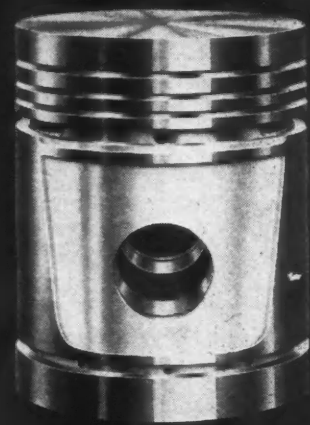
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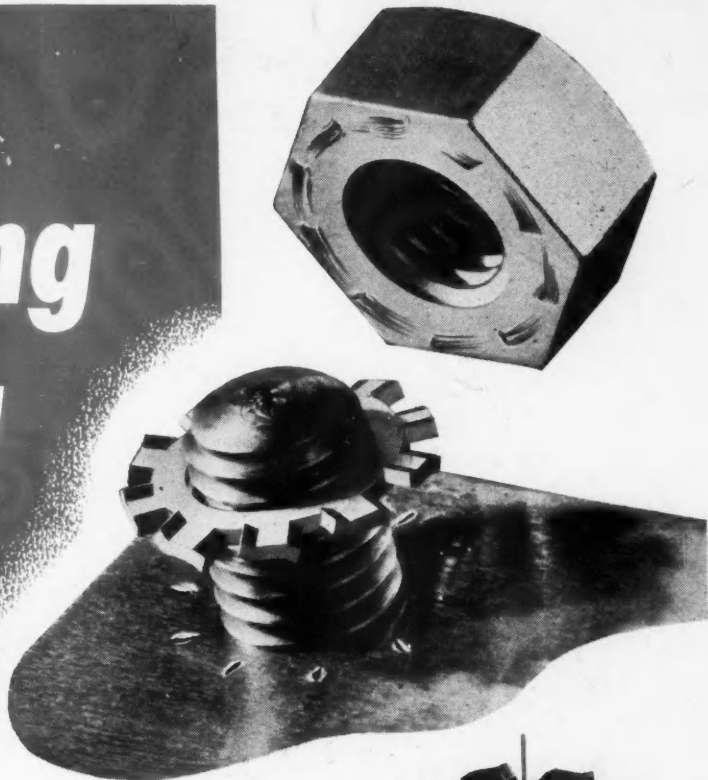






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...WHEN AND WHERE  
IT COUNTS!

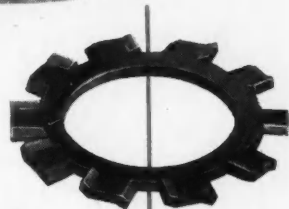


- Here's photographic evidence that EverLOCK washers really take hold with a grip that defies every loosening action. Note how EverLOCK wide chisel edges have dug into the contiguous faces of both work and nut to provide several times more area of resistance than other washers.

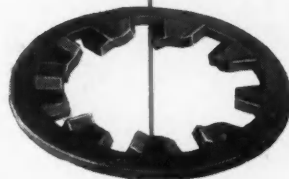
Guard your assemblies with EverLOCK . . .  
The Washer That Has The Edge. Fast, easy application saves assembly time—automatically safeguards against stretching of bolts or distortion of threaded parts. Four standard types meet most lock washer needs.

**Ever**  
**LOCK**  
**WASHERS**

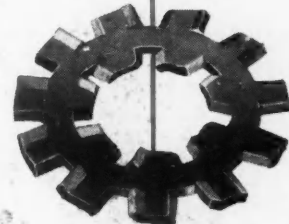
THE WASHER THAT HAS THE EDGE



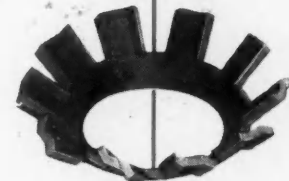
*Standard  
External EverLock*



*Standard  
Internal EverLock*

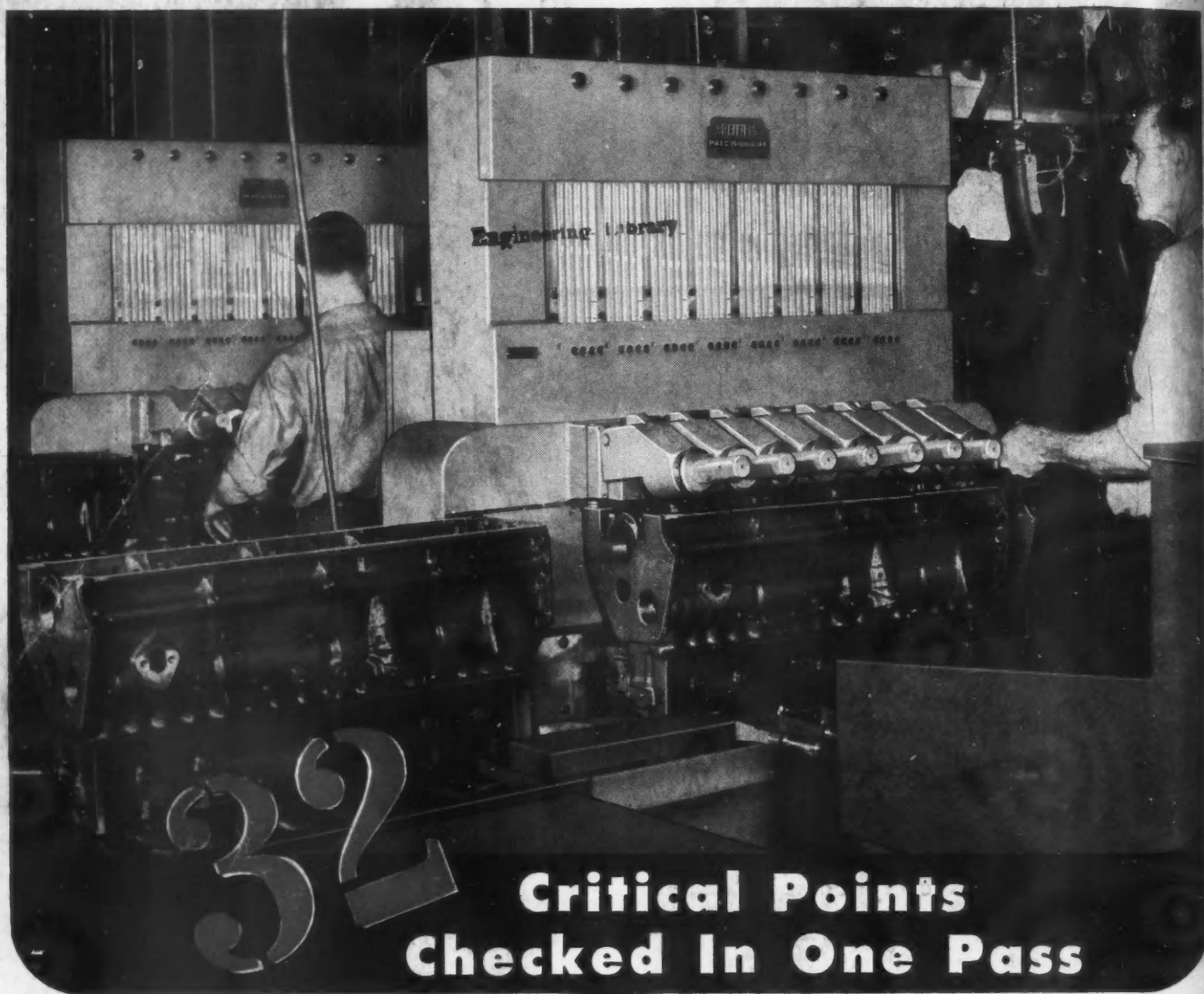


*Standard Internal-  
External EverLock*



*Standard  
80° Countersunk EverLock*

**THOMPSON-BREMER & CO.** 1642 W. HUBBARD STREET, CHICAGO 22, ILLINOIS



## 32 Critical Points Checked In One Pass

One operator on each of these Sheffield Precision Gaging machines checks the diameter in each of the eight cylinder bores at four critical points, and stamps the true diameter of each cylinder into the block for accurate selective assembly—all at a rate exceeding 50 blocks per hour.

Engineering Library

*Check* with Sheffield for possible ways to reduce your production costs and at the same time better product quality. Call Sheffield's local representative or write to us in Dayton.

These gaging machines are right in the production line and are handled by production men. Skilled inspectors are not required because accuracy and productivity does not depend on the human equation.

Savings exceed significant original estimates and are accomplished in comparison with other methods requiring many skilled inspectors, large floor areas and considerably more time for inspection.

**[ Standard gages and measuring instruments shipped within 24 hours. ]**



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*Dayton 1, Ohio, U.S.A.*

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